



Precision Strike Annual Programs Review

"Role of Precision Engagement in Asymmetric Warfare"

April 18-19, 2006

Arlington, VA

Annual Program Review Presentation List

ROLE OF NON-LETHAL WEAPONS IN THE GLOBAL WAR ON TERROR:

Dr. John Alexander, Senior Fellow at Joint Special Operations University & Author of Future War -- with foreword by Tom Clancy -- and the sequel, *Winning the War*.

INTERNATIONAL PROGRAMS:

- Precision Effects-Storm Shadow:
Air Vice-Marshal Nigel Day, CBE BSc(Eng) RAF (Rtd), Senior Defence Adviser (UK), MBDA Missile Systems
- Brimstone-The Royal Air Force's new Precision Strike Weapon:
Mr. Jim Mulholland, Weapons Leader, No 31 Squadron RAF
- RAAF Precision Strike Programs Overview::
Air Commodore Graham Bentley, RAAF, Air Attaché, Australian Embassy

DIRECTED ENERGY WEAPONS PANEL--INDUSTRY PERSPECTIVES:

- Raytheon Perspective:
Mr. Mike Booen, VP for Advanced Missile Defense and Directed Energy Weapons, Raytheon
- Northrop Grumman Perspective:
Mr. Dan Wildt, Director, Business Development, Directed Energy Systems
- Sol Oriens Perspective:
Mr. Mark Fleenor, President, Sol Oriens
- Boeing Perspective:
Dr. Robert Van Allen, Acting Director, National Teams

ANALYSIS OF CURRENT JOINT COMBAT OPERATIONS IN AFGANISTAN AND IRAQ:

Major General David C. Ralston, USA, Commanding General, U.S. Army Field Artillery Center & Fort Sill

KEYNOTE SPEAKER:

Major General Jeffrey A. Sorenson, USA Deputy for Acquisition & Systems Management to the Assistant Secretary of the Army for Acquisition, Logistics & Technology

JOINT DEEP STRIKE SYSTEMS:

- Small Diameter Bomb:
Colonel Richard D. Justice, USAF, 918 ASG Commander

PRECISION ATTACK TO ENSURE DOMINANT MANEUVERS:

- Viper Strike:
Mr. Steven Borden, Deputy PM, Submunitions, Product Office Lead Systems Engineer, Submunitions

PRECISION STRIKE ACQUISITION PANEL:

- Naval Perspective:
Honorable Delores Etter—Assistant Secretary of the Navy for Research, Development and Acquisition

PRECISION STRIKE ANNUAL PROGRAMS REVIEW – APRIL 17-18, 2006

Major General Michael A. Vane, USA

Vice Director for Force Structure, Resources and Assessment (J-8)

(Presentation not authorized for public released)

Dr. John Alexander

Senior Fellow at Joint Special Operations University & Author of *Future War*—with foreword by Tom Clancy—and the sequel, *winning the War*.

Precision Effects—Storm Shadow: *Air Vice-Marshal Nigel Day CBE BSc(Eng) RAF (Rtd)*

Senior Defence Adviser (UK), MBDA Missile Systems

Brimstone—The Royal Air Force's new Precision Strike Weapon: *Jim Mulholland*

Weapons Leader, No 31 Squadron RAF

RAAF Precision Strike Programs Overview: *Air Commodore Graham Bentley, RAAF*

Air Attaché, Australian Embassy

Raytheon Perspective: *Mike Booen*—VP for Advanced Missile Defense and Directed Energy Weapons, Raytheon

Lockheed Perspective: *Mike Bright*—Director, Advanced Directed Energy

(Presentation not authorized for public released-limited distribution only)

Northrop Grumman Perspective: *Dan Wildt*—Director, Business Development, Directed Energy Systems

ATK Perspective: *Dr. Tony Castrogiovanni*—VP Strike Weapons and Directed Energy

(Presentation not authorized for public released)

Sol Oriens Perspective: *Mark Fleenor*

President, Sol Oriens

Boeing Perspective: *Dr. Robert Van Allen*

Acting Director, National Teams

Rear Admiral David L. "Deke" Philman, USN

Deputy Commander, Joint Space and Global Strike, United States Strategic Command

(still awaiting approval for distribution – please check back)

Major General David C. Ralston, USA

Commanding General, U.S. Army Field Artillery Center & Fort Sill

Colonel Curis Mathis, USA

Joint IED Defeat Organization, Office of the Deputy Secretary of Defense

(Presentation not authorized for public released)

Major General Jeffrey A. Sorenson, USA

Deputy for Acquisition & Systems Management to the Assistant Secretary of the Army for Acquisition, Logistics & Technology (still awaiting approval for distribution – please check back)

Brigadier General Andrew Dichter, USAF

Deputy Director, Directorate of Operational Capability Requirements
(Presentation not authorized for public released)

Lt Col Stephen Davis, USAF

(Presentation not authorized for public released)

Colonel Richard D. Justice, USAF

918 ASG Commander

Anthony L. Pang

Hard Target Defeat Program Manager, CXSH/CIVGS15 Department of Defense, DTRA
(Presentation not authorized for public released—limited distribution only)

LTC Bill Cole, USA

Deputy PM, Combat Ammunition Systems

George M. Svitak—Deputy Director, Business Development, NetFires LLC, Raytheon Missile System

(Presentation not authorized for public released)

John McVey—Guided MLRS

(Presentation not authorized for public released)

Steven Borden

Deputy PM, Submunitions, Product Office Lead Systems Engineer, Submunitions

Honorable Delores Etter—Assistant Secretary of the Navy for Research, Development and Acquisition

THE ROLE OF NON-LETHAL WEAPONS IN THE GLOBAL WAR ON TERROR

John B. Alexander, Ph.D.

Senior Fellow

Joint Special Operations University

PRECISION STRIKE ASSOCIATION

Crystal City, Virginia

18 April 2006

FUTURE WAR:

NLW in 21st Century Warfare

St. Martin's Press, 1999

WINNING THE WAR

St. Martin's Press

July 2003

Contact: Email: Nonlethal2@aol.com, (702) 804-5575

NON-LETHAL DEFENSE: A DEFINITION

**PRAGMATIC USE OF FORCE DESIGNED
TO MINIMIZE LOSS OF LIFE WHILE
ACCOMPLISHING A MILITARY OBJECTIVE**

- **GOALS INCLUDE:**
- **NO UNINTENTIONAL LOSS OF HUMAN LIFE**
- **CONTROLLED LEVELS OF PHYSICAL DAMAGE**
- **EXPANDED OPTIONS FOR COMMANDERS**



RECENT HISTORY OF NON-LETHAL WEAPONS

**TENN VS
GARNER**

**IRANIAN
HOSTAGE**

**1986 DOJ
CONFERENCE**

**COMPETITIVE
STRATEGIES**

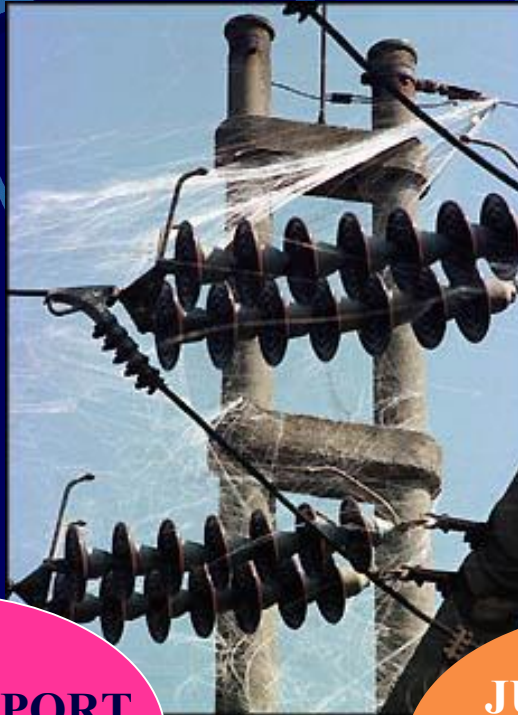
**PEACE SUPPORT
OPERATIONS**

**JUST CAUSE/
UPHOLD
DEMOCRACY**

**URBAN
COMBAT**

**GLOBAL
WAR ON
TERROR**

**STRATEGIC
PARALYSIS**



WHY NON-LETHAL WEAPONS?

- **GEOPOLITICAL SITUATION**
- **MATURITY OF TECHNOLOGY**
 - **NEW EFFECTS BASED CAPABILITY**
 - **PRECISION STRIKE AVAILABILITY**
- **PEACE SUPPORT OPERATIONAL EXPERIENCE**
 - **SOMALIA**
 - **HAITI**
 - **BALKANS**
- **GLOBAL WAR ON TERROR**
 - **COMPLEX TERRAIN**
 - **CONTROL COLLATERAL CASUALTIES**



credit: Randy Morroya
Sandia National Laboratories

EVOLUTION OF US MILITARY USE OF NLWS

PANAMA



SOMALIA

HAITI



KOSOVO

NON-LETHAL WEAPONS TECHNOLOGIES



BEANBAG ROUNDS



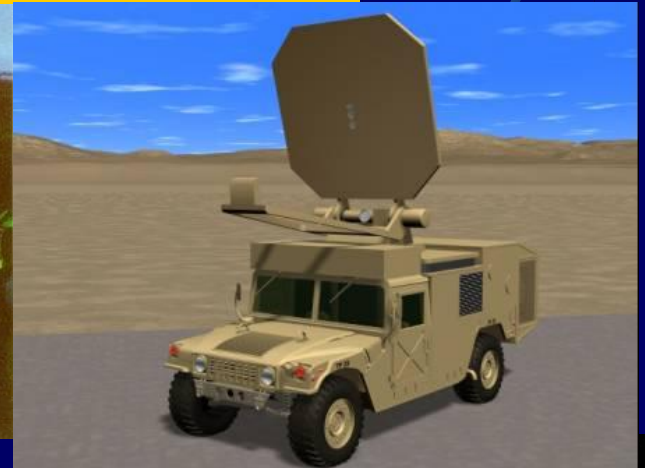
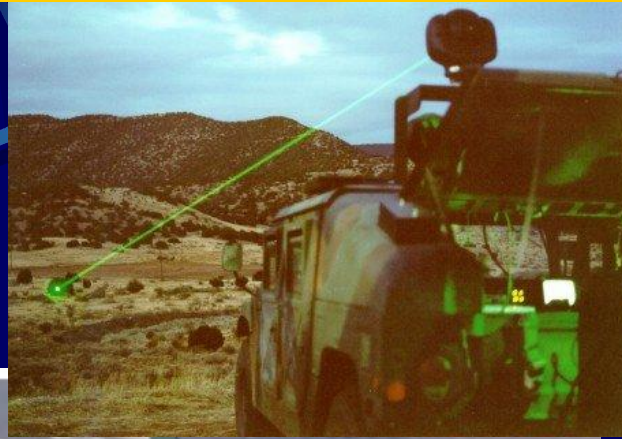
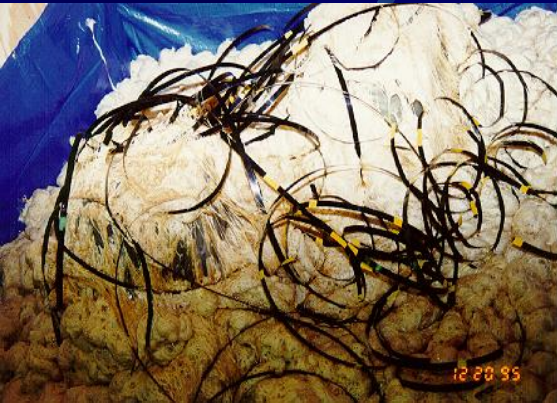
PepperBall Used To Stop Attacker in San Diego



PORTABLE VEHICLE STOPPER



ADVANCED NLWS ARE COMING



LEGAL REVIEW OF NON-LETHAL WEAPONS



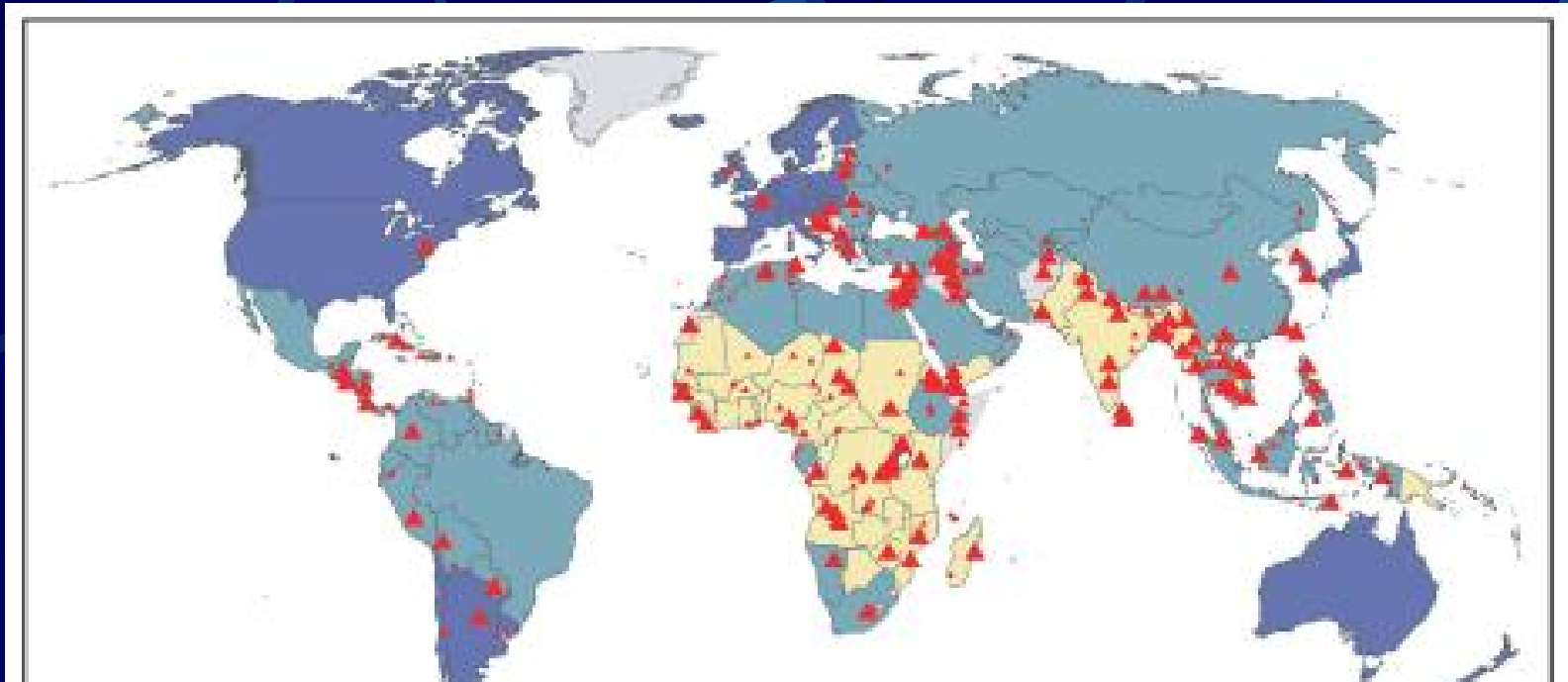
SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- **NLWs make it easier to initiate war**
- **NLWs will start a new arms race**
- **NLWs may be used as instruments of torture**
- **NLWs will result in some deaths and serious injuries**
- **NLWs used as a precursor and easier to kill opponents**
- **NLWs will be used to suppress lawful dissent**
- **NLWs do not have sufficient data to support their use**

SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- ***NLWs make it easier to initiate war***
- **NLWs will start a new arms race**
- **NLWs may be used as instruments of torture**
- **NLWs will result in some deaths and serious injuries**
- **NLWs used as a precursor and easier to kill opponents**
- **NLWs will be used to suppress lawful dissent**
- **NLWs do not have sufficient data to support their use**

A DECADE OF CONFLICT



AFGHANISTAN



SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- NLWs make it easier to initiate war
- ***NLWs will start a new arms race***
- NLWs may be used as instruments of torture
- NLWs will result in some deaths and serious injuries
- NLWs used as a precursor and easier to kill opponents
- NLWs will be used to suppress lawful dissent
- NLWs do not have sufficient data to support their use

WHAT NEW ARMS RACE???

WORLD NLW \$50M/Yr



Non-Lethal Weapons are 0.012% of US DOD Budget

SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- NLWs make it easier to initiate war
- NLWs will start a new arms race
- ***NLWs may be used as instruments of torture***
- NLWs will result in some deaths and serious injuries
- NLWs used as a precursor and easier to kill opponents
- NLWs will be used to suppress lawful dissent
- NLWs do not have sufficient data to support their use

NLWS AND TORTURE



Monk with torture devices used by Chinese

TORTURE IS AN ISSUE OF HUMAN INTENT- NOT DEVICES

NLWS AND TORTURE



Monk with torture devices used by Chinese



Victoria with instruments of torture

TORTURE IS AN ISSUE OF HUMAN INTENT- NOT DEVICES



NEW SCIENTIST

NewScientist.com

"The World's No. 1 Science & Technology News Service"

<http://www.newscientist.com/article.ns?id=dn7077>

Maximum pain is aim of new US weapon

19:00 02 March 2005

Exclusive from New Scientist Print Edition

David Hambling



E. P. Industries, Inc. / Mission Research Corp.

"It could be used for torture..." John Wood, University College London

"I am deeply concerned about the ethical aspects..." Andrew Rice

"Pain researchers are furious...." David Hambling

SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- NLWs make it easier to initiate war
- NLWs will start a new arms race
- NLWs may be used as instruments of torture
- **NLWs will result in some deaths and serious injuries**
- NLWs used as a precursor and easier to kill opponents
- NLWs will be used to suppress lawful dissent
- NLWs do not have sufficient data to support their use

NLW DEATHS AND INJURIES



**17 deaths with 125,000 rounds fired
Probability of fatality 0.00014**

Compared to what????

More than 110 deaths of children under 6

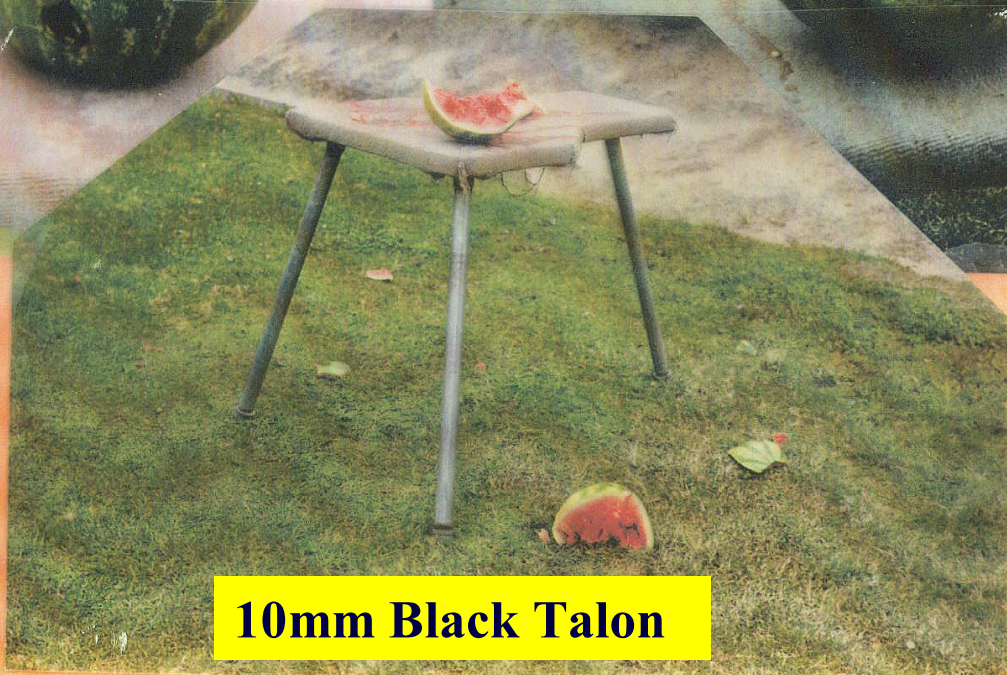
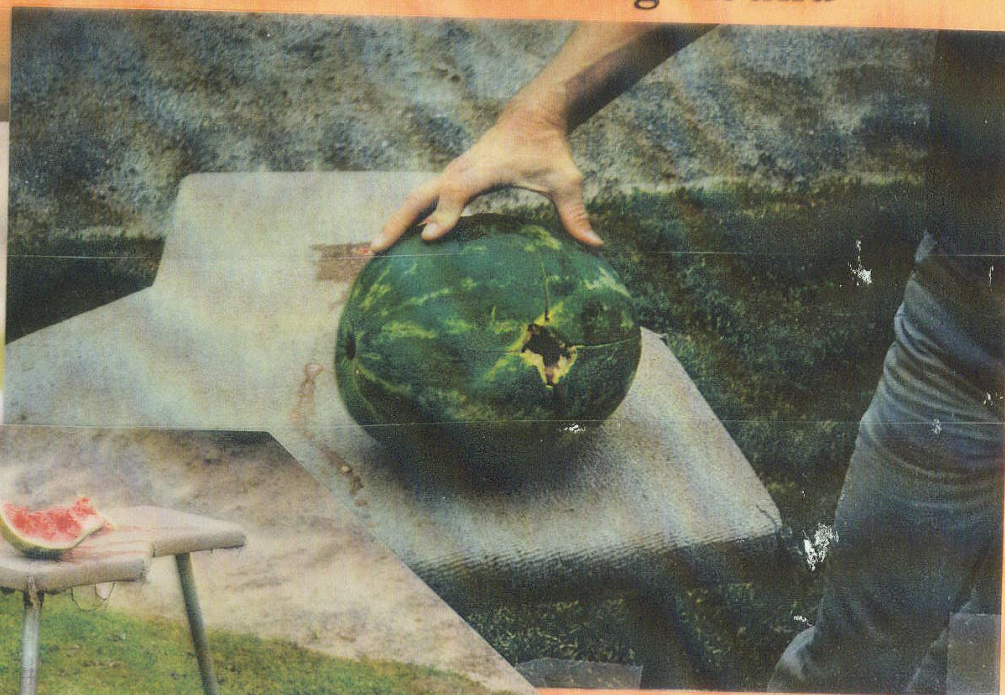
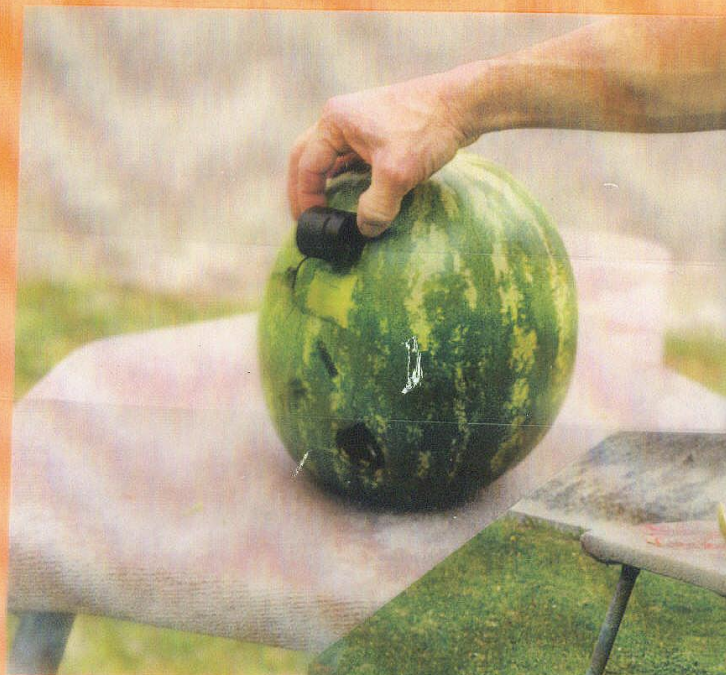


THE ISSUE IS TRAINING AND SUPERVISION

COMPARED TO WHAT?

Foam Baton

Bean-Bag Round



10mm Black Talon

TASER AS TARGET



CATCH 22

- **103 DEATHS FROM TASER??** (AI 14 April 06)
- **ONLY 6 AUTOPSIES FIND TASER A CONTRIBUTING FACTOR**
- **NO INDEPENDENT RESEARCH - WHAT ABOUT THE AUTOPSIES**
- **HOW MANY IN-CUSTODY DEATHS WITHOUT TASER?**
- **WHAT IS THE TIMING OF NEWS ARTICLES?**
- **INDUSTRIAL ESPIONAGE/SABOTAGE**
- **NO NEWS STORY EVER DIES – EVEN WHEN DISPROVED**



IS THERE AN AGENDA???

**Amnesty International
Calls For Taser Suspension**

**EPIDEMIC
ERGOFUSION**



**REMEMBER
DEEP THROAT**

SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- NLWs make it easier to initiate war
- NLWs will start a new arms race
- NLWs may be used as instruments of torture
- NLWs will result in some deaths and serious injuries
- *NLWs used as a precursor and easier to kill opponents*
- NLWs will be used to suppress lawful dissent
- NLWs do not have sufficient data to support their use

NAILING A FOOT TO THE FLOOR

MOSCOW THEATER



A MATTER OF CHOICE

INCAPACITATING AGENTS

WHAT YOU DID READ:

- NERVE GAS KILLED RUSSIAN HOSTAGES (UPI)
- DEADLY END TO MOSCOW SIEGE SHOWS DANGERS OF INCAPACITATING CHEMICALS (AP)
- CONCERN ARISES OVER TYPE OF GAS USED BY MOSCOW (WASH POST)
- USE OF GAS RISKS OTHERS FOLLOWING SUIT (SF CHRONICLE)



WHAT YOU SHOULD HAVE READ:

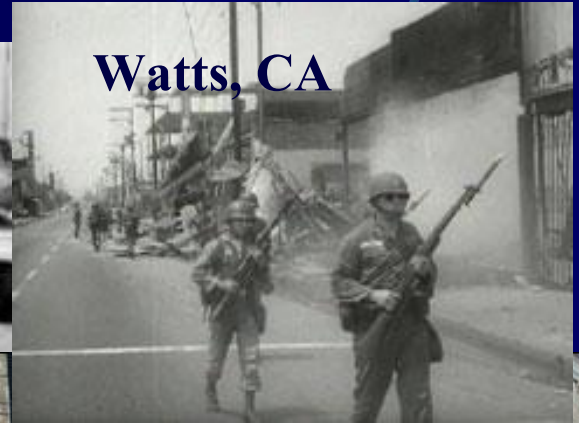
HUNDREDS SAVED BY USE OF INCAPACITATING AGENT

**WOULD YOU SET TODAY'S SPEED LIMITS BASED ON
AUTOMOBILE TECHNOLOGY OF 1900???**

SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- NLWs make it easier to initiate war
- NLWs will start a new arms race
- NLWs may be used as instruments of torture
- NLWs will result in some deaths and serious injuries
- NLWs used as a precursor and easier to kill opponents
- *NLWs will be used to suppress lawful dissent*
- NLWs do not have sufficient data to support their use

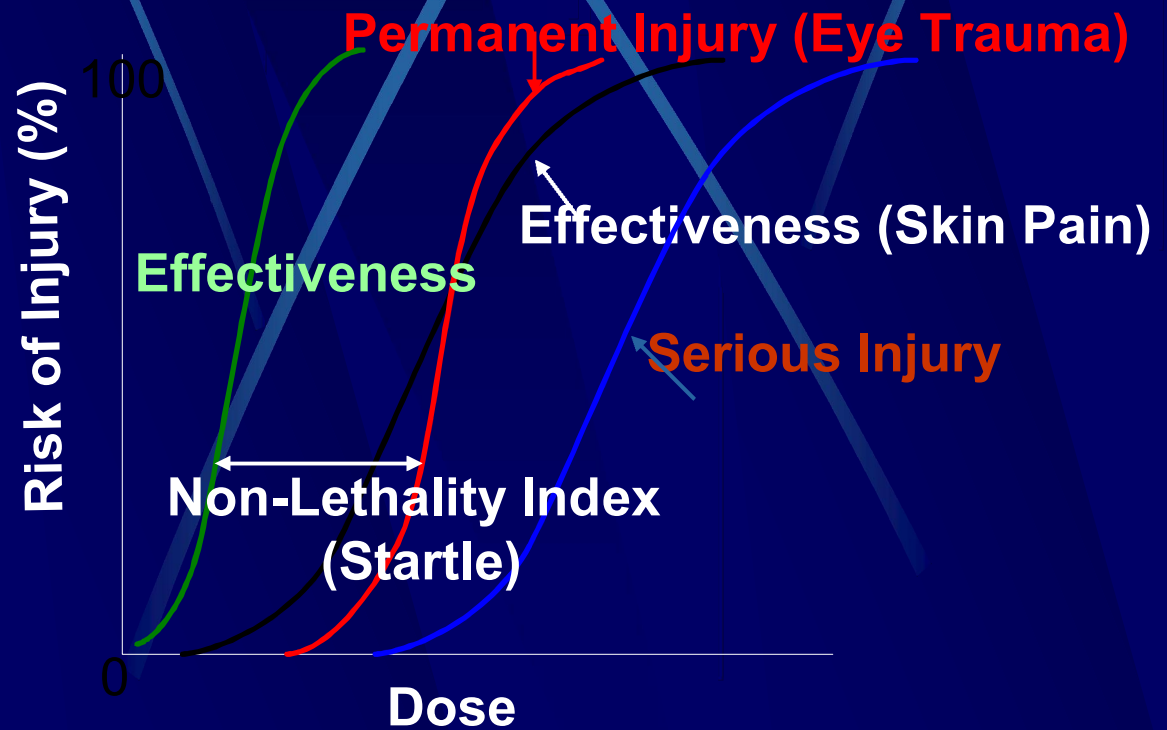
SUPPRESSING DISSENT



SEVEN DEADLY SINS OF NON-LETHAL WEAPONS

- NLWs make it easier to initiate war
- NLWs will start a new arms race
- NLWs may be used as instruments of torture
- NLWs will result in some deaths and serious injuries
- NLWs used as a precursor and easier to kill opponents
- NLWs will be used to suppress lawful dissent
- **NLWs do not have sufficient data to support their use**

HOW GOOD IS GOOD ENOUGH?



BUT WHAT ABOUT PEOPLE WHO:

- **HAVE PACEMAKERS?**
- **EXTREME HEART CONDITIONS?**
- **ARE ASTHMATIC?**
- **ARE VERY OLD?**
- **ARE BLIND, DEAF MIDGETS WITH PARKINSON'S ?**

“Life is tough; it’s tougher when you’re stupid.”

John Wayne as SGT John Stryker

Sands of Iwo Jima

PERCEPTION

THE PROBLEM OF DIFFERING WORLD VIEWS

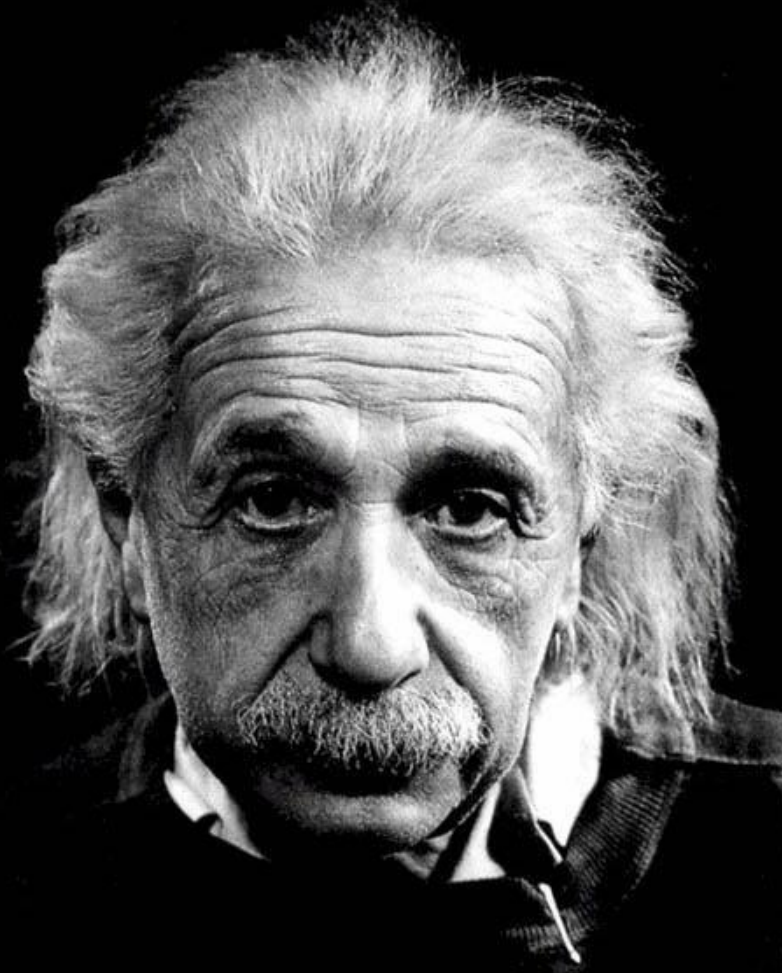
AIN'T IT AWFUL???

THE WORLD AS SEEN BY PHILOSOPHICAL GROUPS



THE WORLD AS IT IS





“There are two things that are infinite.....the universe and human stupidity. And I’m not sure about the former.”

RECONSIDERATION OF ISSUES

- **WHAT PROBLEM ARE YOU SOLVING?**
- **COMPLAINTS BASED ON EMOTION VS. FACTS**
- **BLAME TECHNOLOGY FOR HUMAN PROBLEMS**
- **CHEMICAL & BIOLOGICAL AGENTS HAVE PEACEFUL PURPOSES**
- **MORE OPTIONS ARE PREFERABLE TO LESS**
- **THE RESULTS ARE IN: NLWS ARE NOT A ROAD TO HELL**



THE PRIMARY QUESTION SHOULD BE:

COMPARED TO WHAT?

COMING SOON TO A COMMUNITY NEAR YOU

NLWS: NOW MORE THAN EVER



IS IT BETTER THAN A ROCK?



**WE NEED PRECISION STRIKE BEYOND 60 METERS:
PREFER HUNDREDS OF METERS**

NOW IT'S YOUR KIDS IN THE SCHOOL: WHAT WEAPONS DO YOU WANT POLICE TO USE??



THANK YOU FOR YOUR SERVICE TO OUR COUNTRY



Air Delivered Weapons Roadmap



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

Purpose

To provide the background to Roadmaps in Defence, the background for the *Air Delivered Weapons Roadmap* specifically, and to provide a summary of the outcomes at an unclassified level



Scope

Current Capability

Roadmaps in the ADF

The *Air Delivered Weapons
Roadmap (ADWR)*

Key outcomes



Scope

Current Capability

Roadmaps in the ADF

*The Air Delivered Weapons
Roadmap (ADWR)*

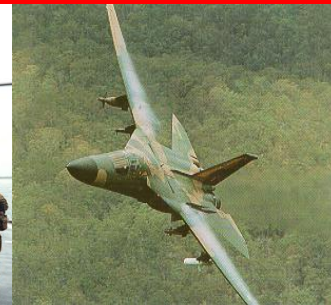
Key outcomes



AUSTRALIAN DEFENCE FORCE

- 55000 Personnel
- Approx A\$15b (US\$11b) per annum (1.8% GDP)
- Approx A\$3-4b new capability investment per annum

'A balanced, networked and deployable force, manned by dedicated and professional people, which excels at joint and coalition operations'



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

F-111, F/A-18, AP-3C, Helicopters



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

Scope

Current Capability

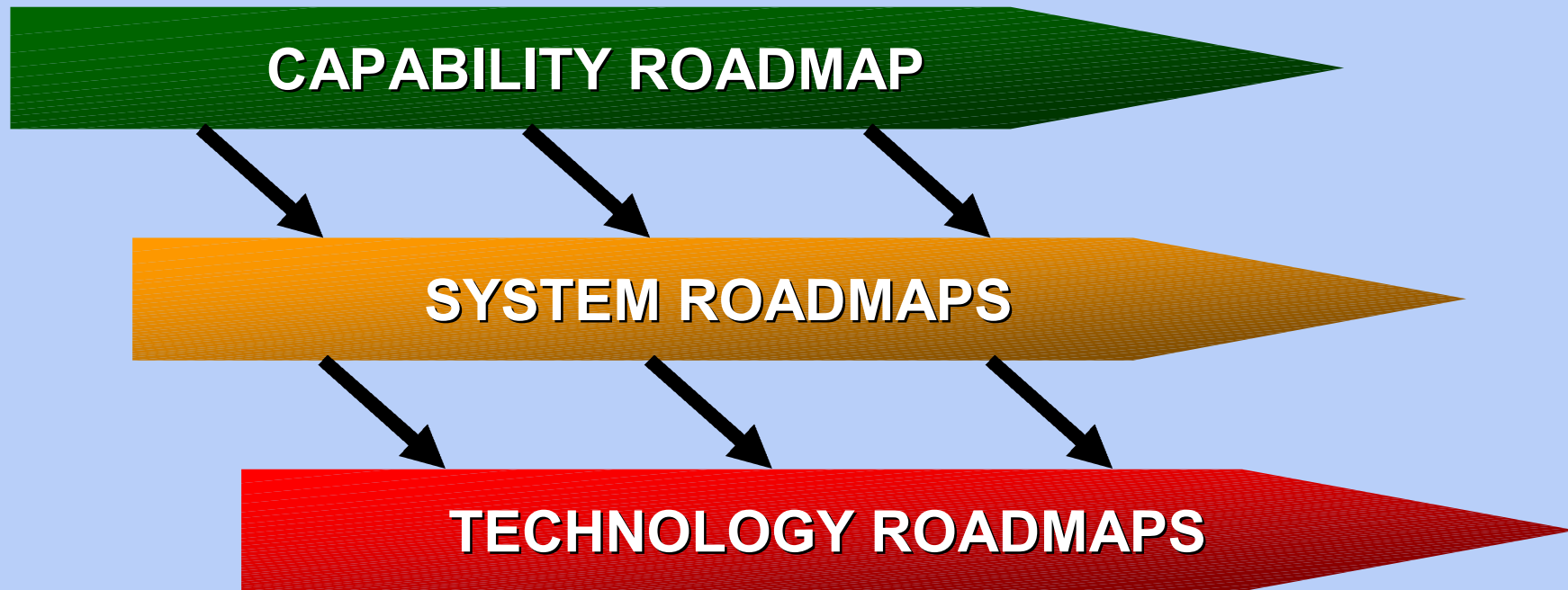
Roadmaps in the ADF

*The Air Delivered Weapons
Roadmap (ADWR)*

Key outcomes



CAPABILITY ROADMAPS



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

Scope

Current Capability

Roadmaps in the ADF

The *Air Delivered Weapons
Roadmap (ADWR)*

Key outcomes



ADWR Desired Outcomes

- **set a vision for air delivered weapons to 2025 and beyond**
- **provide strategies that address FIC**
- **identify opportunities and risks**
- **identify key inputs and enablers**



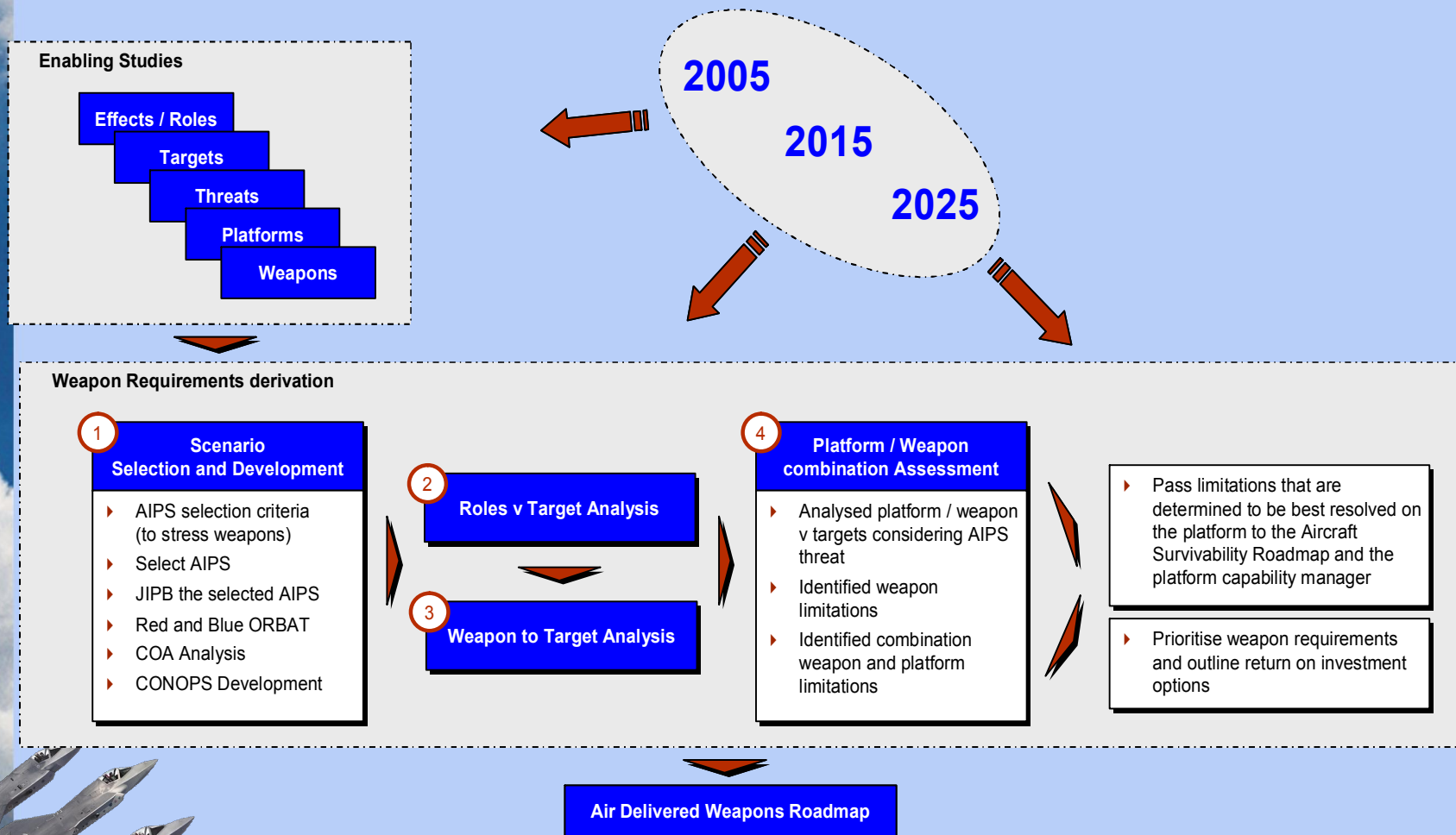
Weapons contextual issues



ADWR Methodology

A
E
R
O
S
P
A
C
E

D
E
V
E
L
O
P
M
E
N
T



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

Capable threat environment

- Proliferation of 4th Generation fighters (4.5th and introduction of 5th?)
- Advanced Air to Air missile systems
- Advanced Surface to Air missile systems
- Improved IADS and NCW environments
- White Paper 2000 “air combat forces that are at least comparable qualitatively to any in the region”



ADWR Weapons Technology Study

- Operational focus, rather than lab
- Seekers and sensors
- Guidance and control
- Propulsion
- Warheads and kill mechanisms
- Radiated energy weapons
- Countermeasures
- Enabling technologies
- Life cycle and logistics support



ADWR key target trends were:

- Hardened targets
- Underground targets
- Improved camouflage
- Low signature air targets
- Mobile or relocatable targets
- Non-lethal and very low collateral damage effects



Weapon requirements criteria

- Primary
 - Target type
 - Threat level
 - Targeting
 - Collateral / ROE / Political
 - Environment
 - Roles
- Secondary
 - Distance / time from base
 - Air power dynamics
 - Intensity
 - Support
 - Interoperability



Target types vs roles vs platforms mapping

Role	Sub-role	Mission	Buildings	Bunkers and hardened targets	Underground	Bridges	Mobile radars	Fixed Radar	Armoured Vehicles	Non-armoured vehicles	Field Equipment, machinery and support material	Personnel	Electrical/Communications Infrastructure	Railway lines	Paved surfaces	POL Tanks	Missile on launcher	Surface vessels with AD	Surface vessels without AD	Submarines	Fighters	Transports	UAVs	Missiles in flight	Small, slow/fix wing	Helicopters
Counter Air	Offensive	OCA Attack	✓	✓	✓		✓	✓	✓	✓	✓		✓		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
		Sweep																			✓					
		Force Protection																			✓					
		SEAD	✓	✓	✓		✓	✓	✓	✓	✓		✓				✓	✓								
	Defensive	Active											✓								✓	✓	✓	✓	✓	✓
Strike	Land	Land	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓							✓	✓	✓
		Independent Surface Warfare																✓	✓							
		Independent Under Sea Warfare																		✓						
Aerial Mining	Offensive																	✓	✓	✓						
	Defensive																	✓	✓	✓						
Offensive Air Support	Land	CAS	✓	✓		✓	✓	✓	✓	✓	✓	✓			✓		✓									
		BAI	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓									
	Maritime	Surface Warfare																✓	✓							
		Under Sea Warfare																		✓						
Information Operations	Information Warfare	PSYWAR										✓	✓													



Analysis criteria

- Weapon
 - range
 - accuracy
 - speed/manoeuvrability
 - signature
 - counter-countermeasures
 - interoperability
 - selectable effects
 - specialised weapons
 - directed energy
 - non-lethal
- Enabling system
 - Targets
 - Threat
 - Platform
- Notes:
 - selectable effects included multi-payload, variable fusing
 - specialised weapons included multi-targeting, to contain wmd, loitering, deep/hard, EM disruption



Scope

Current Capability

Roadmaps in the ADF

*The Air Delivered Weapons
Roadmap (ADWR)*

Key outcomes



Desirable weapon characteristics

- Precision
- Selectable
- Size
- Selectable Fusing
- Penetration capability
- Jam resistant
- Third Party Targeting capability
- Range
- Commonality in planning processes
- Affordable
- Network enabled
- Informs BDA process
- Non-lethal options
- Directed Energy



Critical support requirements

- Intelligence
- Targeting requirements
- Logistics
- Infrastructure
- Training
- Interoperability
- NCW considerations



Issues to resolve

- F-18 → JSF
- Harpoon follow-on
- GPS guided munitions
- SDB
- Hellfire
- ASRAAM



ADWR Conclusion

- System Roadmap
- Focuses research
- Entry to Defence Capability Plan



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

Questions?



DEVELOPING FUTURE AEROSPACE CAPABILITY TO FIGHT AND WIN

Raytheon

Directed Energy Applications

...

**When it absolutely has to get
there at the “Speed of Light”**

Mike Booen

Vice President

Raytheon Missile Systems

16 April 2006



**DIRECTED
ENERGY
WEAPONS**

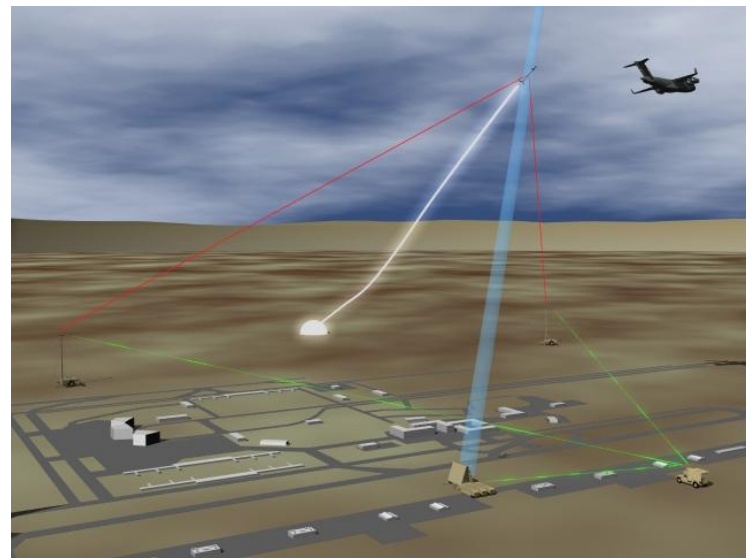
Counter MANPADS Needs the Speed of Light

On-board protection for some aircraft...

and point protection to support expeditionary airfields



Infrared Countermeasures
provide critical asset self-
protection



Raytheon Vigilant Eagle
protects all aircraft at the
airfield

Mature? Reliable? Affordable? Logistics? CONOPS?

Raytheon

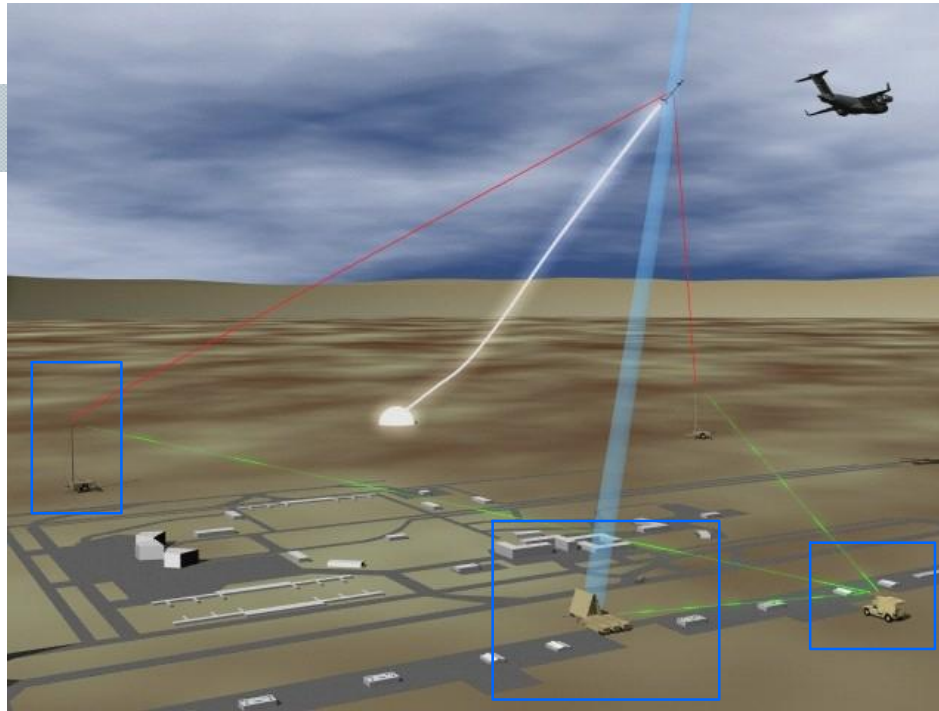
Vigilant Eagle – Mature Hardware Ready for Demonstration

MDT



**Demonstrated and
operational**

HPM
Live Fire Test Results



C2



**Off the Shelf
system currently
in operation**



Laser-Based IR Countermeasures Use the Speed of Light

Affordable, Reliable, Light Weight Aircraft Self-Protection Against Surface & Air Launched Missiles

Missile Warning Coverage

Jamming Radiation

1. Missile launch is detected and a turret is directed onto, and tracks, the missile
2. A low power laser sends a modulated beam of infrared energy to the missile and jams the seeker, causing it to miss

How do you protect the helicopters?

Warfighter Benefits

AH-1Z



- Small size, low weight, low drag ideally suited for constrained rotary wing a/c
- Proven manufacturing ability and attractive high rate production potential
- High reliability consistent with a system leveraging mature hardware / software



Pointer

- Based on Production AIM-9X Pointer



Controller

- Based on Production AIM-9X Controller



Laser

- Multi-band



MW Sensor

- Single color
- Multi color

Technology Push: Non-Lethal Technology

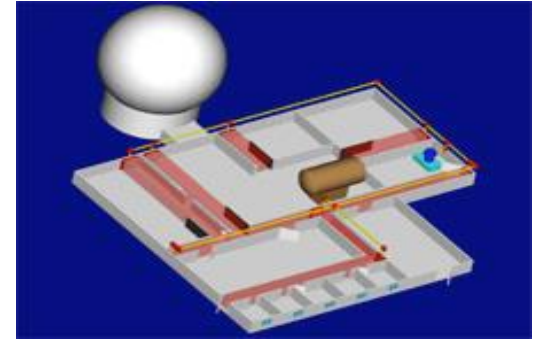
Force Projection



Force Protection



Facility Protection



Shout



**Raytheon . . .
Filling the Void for
our Customers**



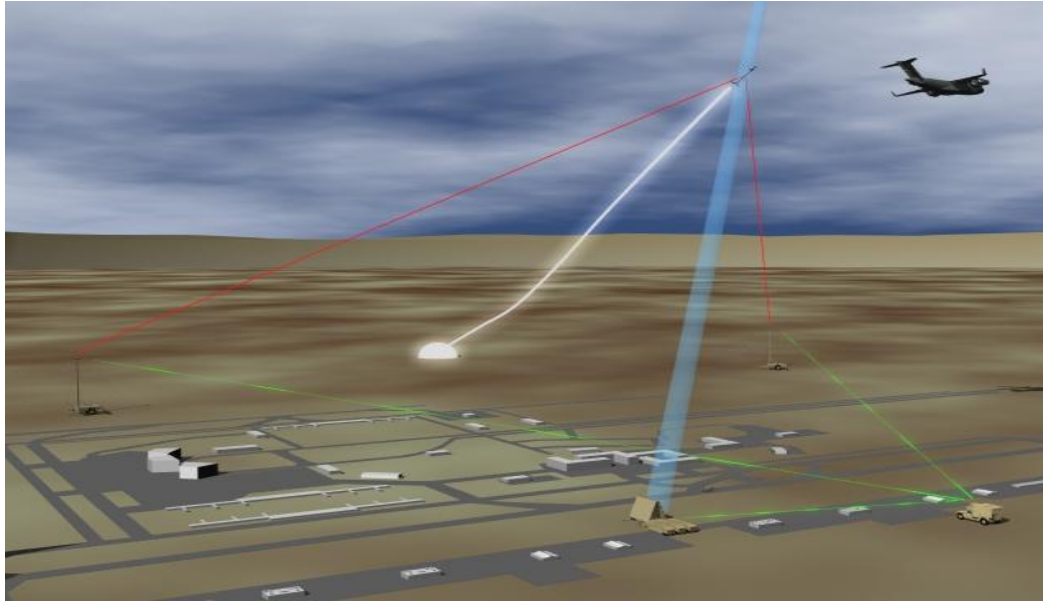
Shoot





- **BACKUP**

Vigilant Eagle



- Vigilant Eagle
 - Affordable capability to counter MANPADS terrorist threat
- HPM effect tested and proven effective in live fire against terrorist threats
 - Missile detect and track capability proven in live fire
 - C2 System Proven

03:32:08

MT:Looking

EL: 3

AZ: < 0





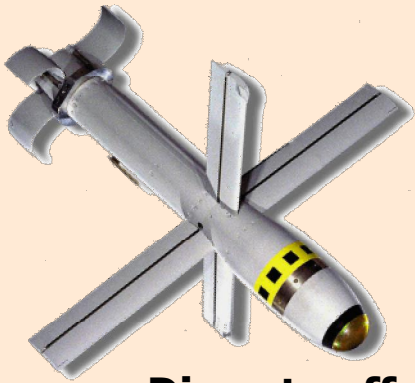
Viper Strike



April 2006

***Steve Borden
DPM Submunitions***

Viper Strike Overview



Diameter	5.5 in.
Wingspan	36 in.
Length	36 in.
Weight	42 lb.
Glide Ratio	10:1
Explosives	2.3 lb.
FOV	14°

- Discrete effects precision munition
 - Semi-active laser (SAL) seeker
 - Near 0m CEP
 - Small warhead
 - Hit-to-kill

Low Collateral Damage

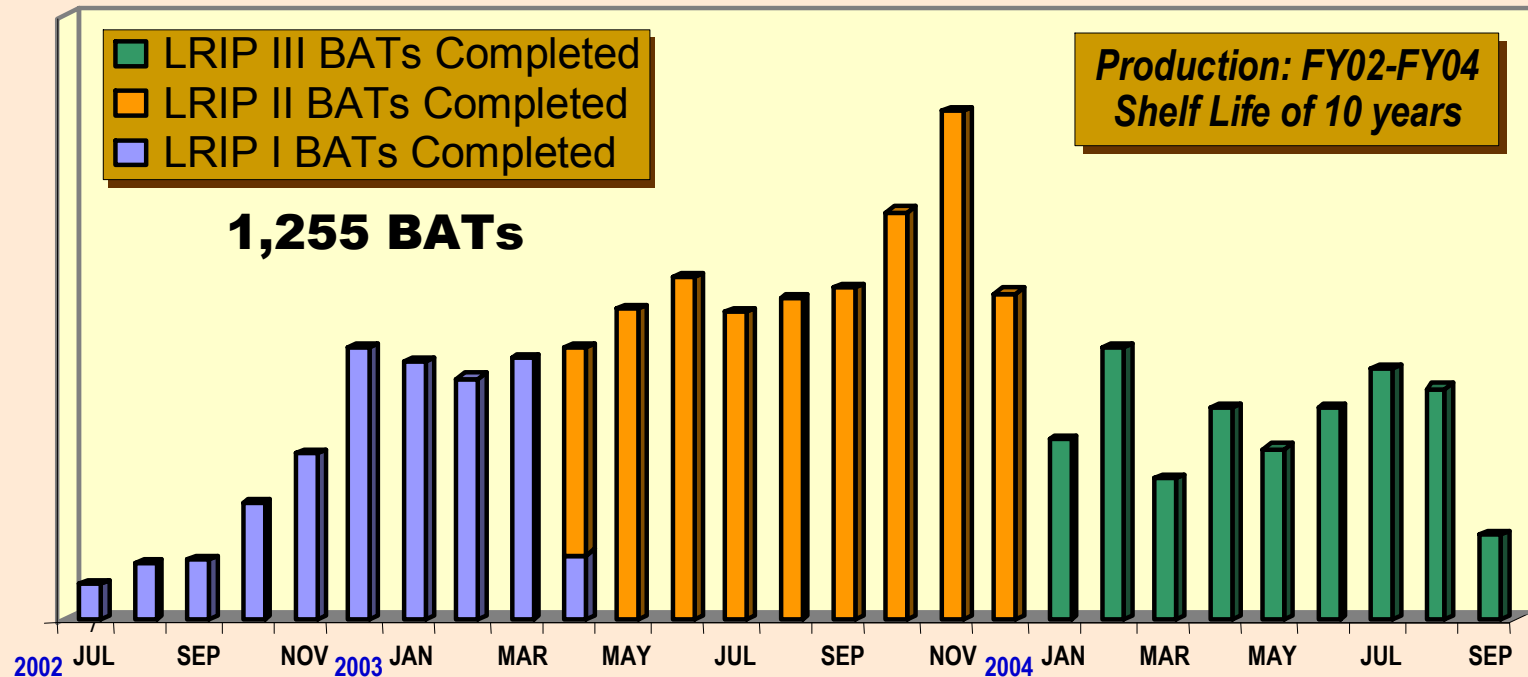
- Production airframe/seeker
- Successful Army demos (9 for 9)

Path Ahead: Demonstrate improvements in 2006

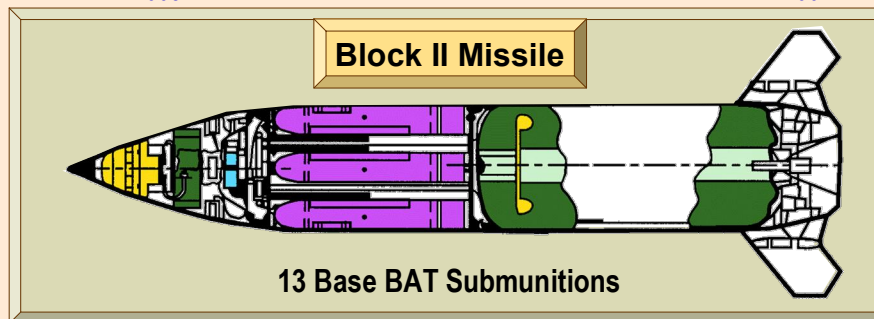
- GPS Extend range to 10+ miles
- Frag belt Personnel targets, plus "less than lethal" mode
- Datalink Max range moving targets; multiple near-simultaneous target attack



ATACMS Conversion



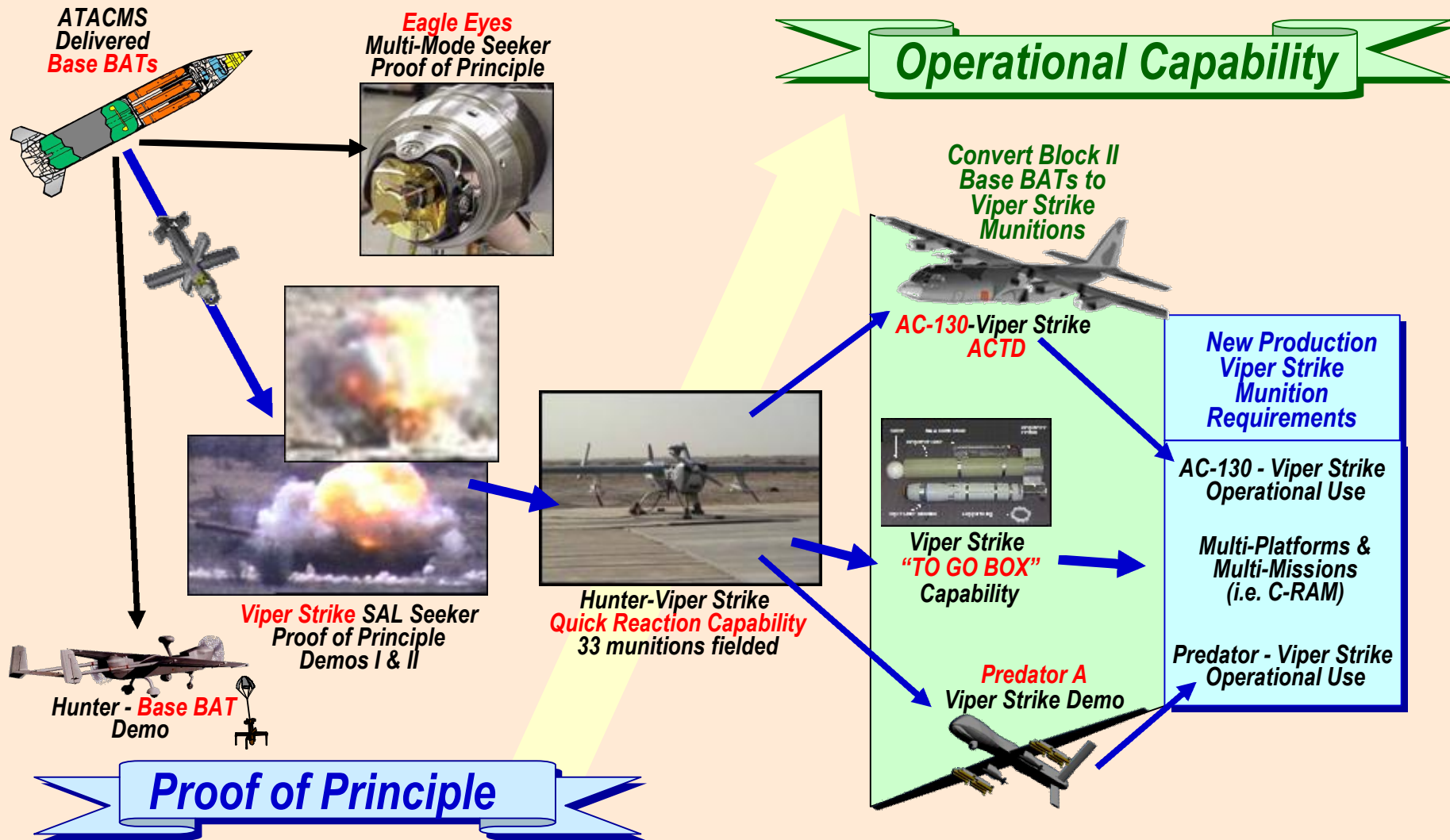
**No ATACMS
Funding to
Maintain or Test
the Current
Inventory**



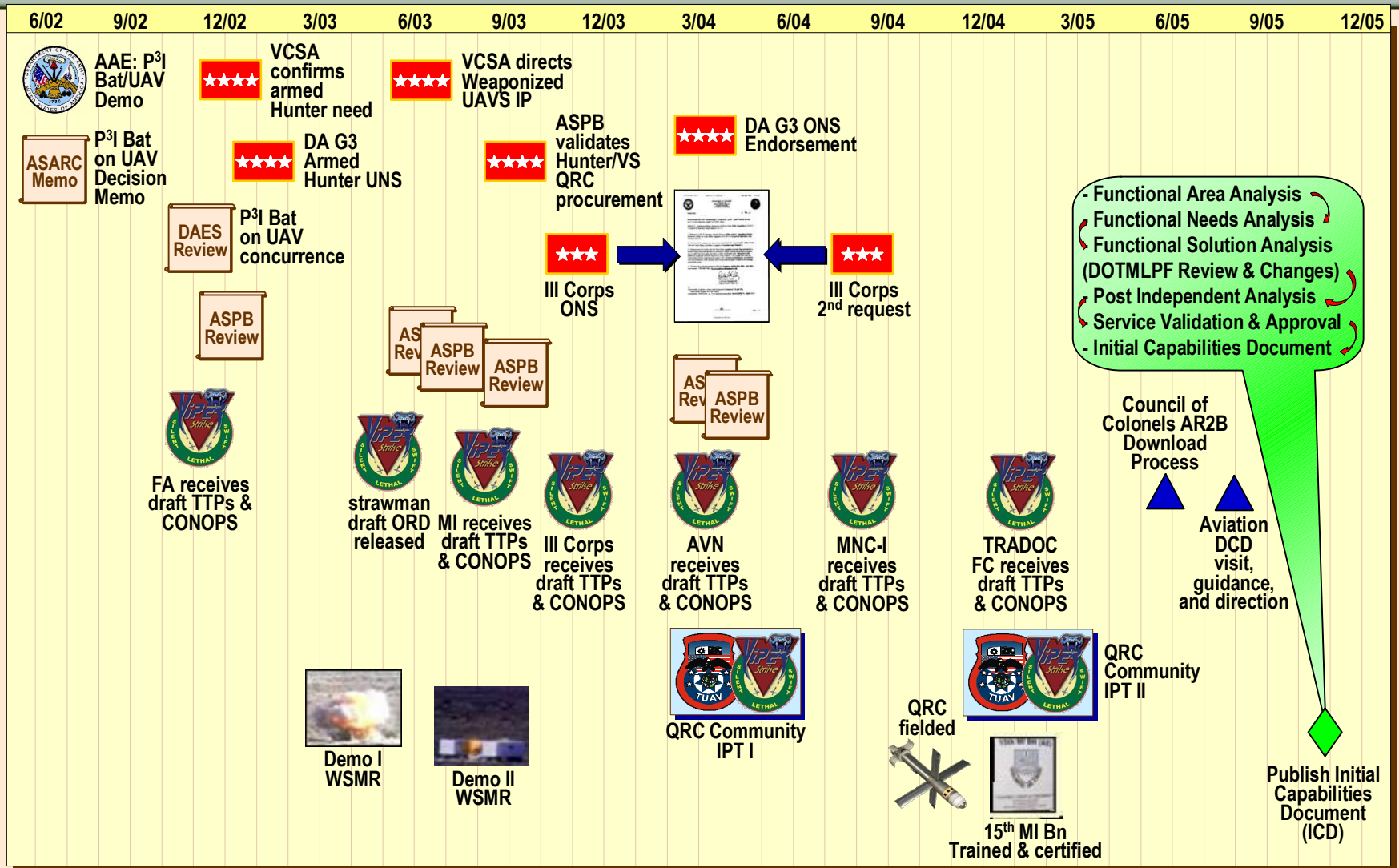
The Viper Strike Solution-

- Shelf Life Issue
- Maintenance Funding
- Unitary Requirement
- Viper Strike Requirement
- Bridges VS New Production

Viper Strike Lineage



Viper Strike's Evolving Requirement





Current Capabilities

- **Launch Altitudes – 8K' to 13K' and No Need to Maneuver**
- **Low Circular Error of Probability – Less than One Meter CEP**
- **Low Collateral Damage – 16 Meters for Urban Targets**
- **Top Down Blast Effect – Limits Damage in Urban Canyons**
- **Moving Targets – Up to 40 kph with Some Target Maneuvering**
- **Danger Close – ATEC Approved at 50 Meters**
- **Double the Payload – Half the Weight of Hellfire**
- **Multiple Laser Designations – Air, Buddy, or Ground**
- **Day or Night Capability – All Laser Designators**
- **Stand Off – 1/2km to 1km Current; >5km w/GPS**
- **Current HE and Kinetic Warheads plus Frag Sleeve Funded**
- **Only Current Munition for Class II & III Weaponized UAVS**
- **Capability Fielded in OIF – Proven & Certified**
- **Active Production Facility at Redstone Arsenal**
- **No Munition Restrictions Beyond Aircraft Limitations**



Current Missions

- ***“Golden Shots”***
 - ***Pinpoint a moving armored car in a motorcade***
- ***Restricted (Minimal Collateral Damage) Urban Targets***
 - ***Reach down into cordoned urban canyons***
 - ***Near vertical angle of attack projects warhead shrapnel into the target and ground minimizing collateral damage***
- ***Convoy & TOC ISR & Security***
 - ***At 10K' AGL, UAVs relatively unseen, unheard, and undetectable***
 - ***Allows observation of enemy preparations, IED placement, and ambush points***
- ***Key Infrastructure ISR & Armed Response***
 - ***Refineries, pipelines, politically sensitive locations, etc.***
- ***Monitor critical situations with timely response***
 - ***Undetected observation without ground troops in harm's way***
- ***Army asset under Army control***

Operation Iraqi Freedom Fielded & Certified!

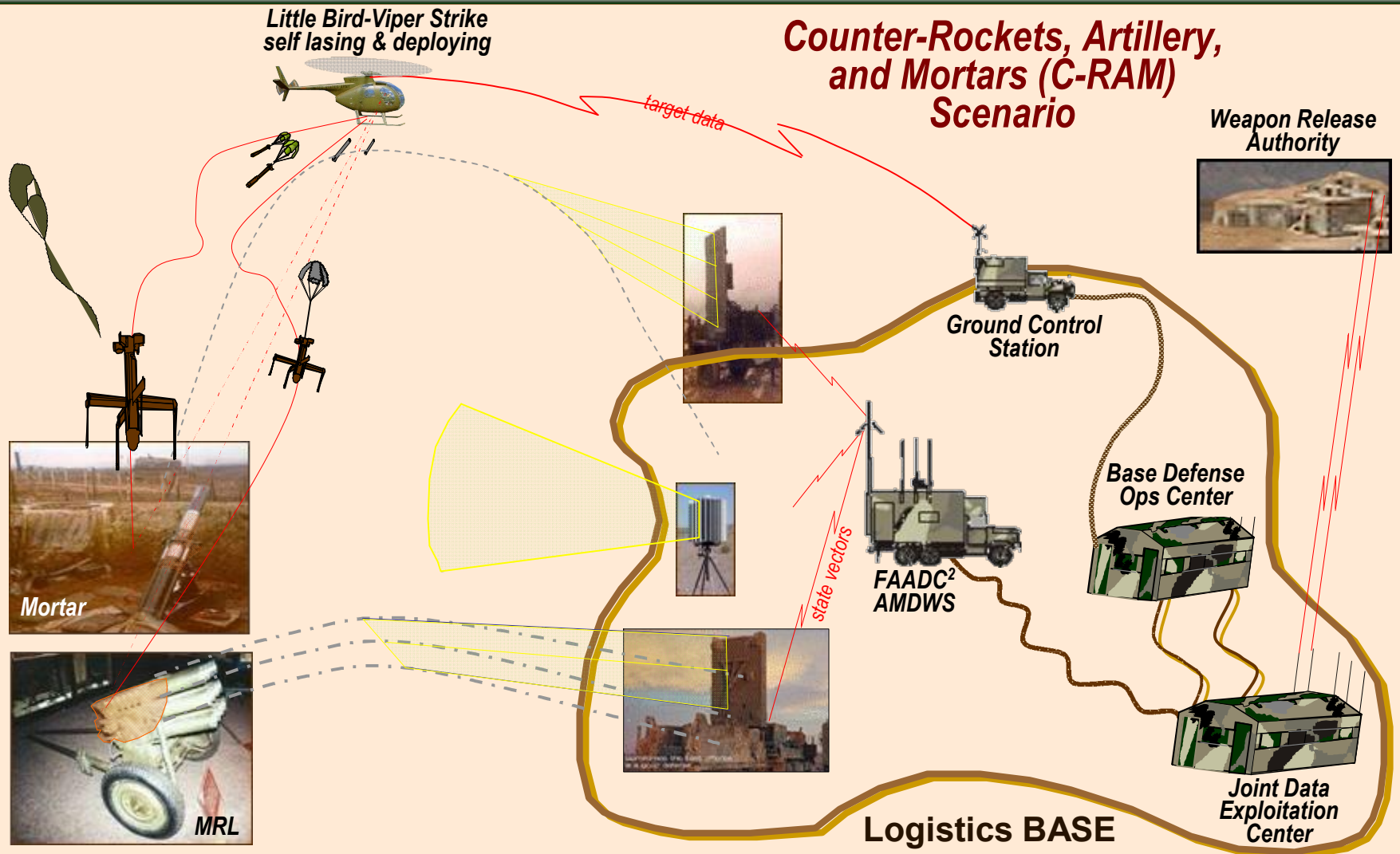




Viper Strike C-RAM Demo



Viper Strike in the C-RAM Mission





Current & Future Carriers



Fire Scout



AC-130 ACTD



Warrior



Predator A



Hunter



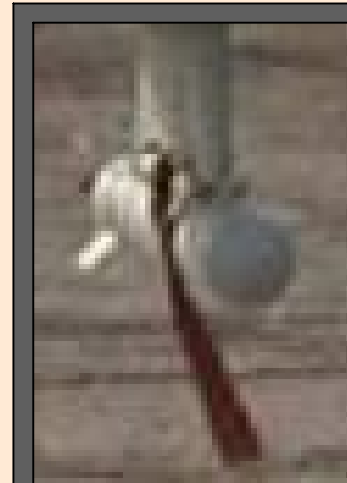
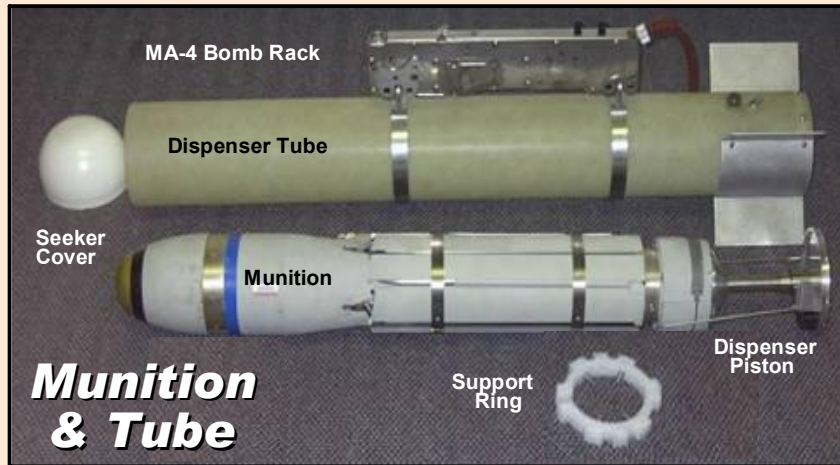
Little Bird



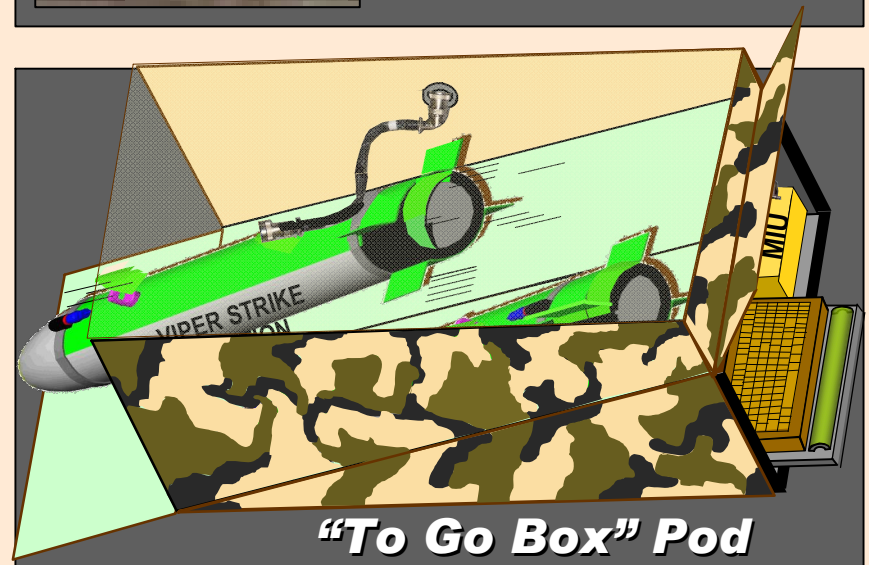
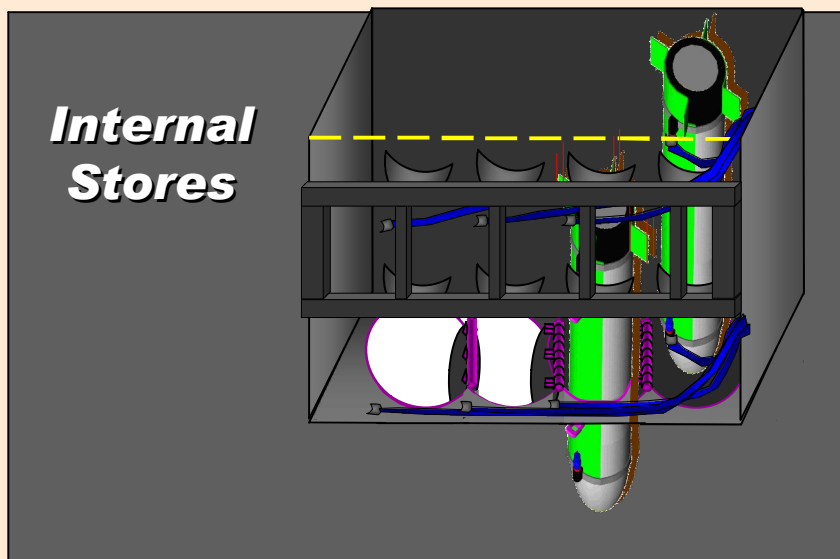
Viper Strike Navigator



Current & Future Packages



External Stores



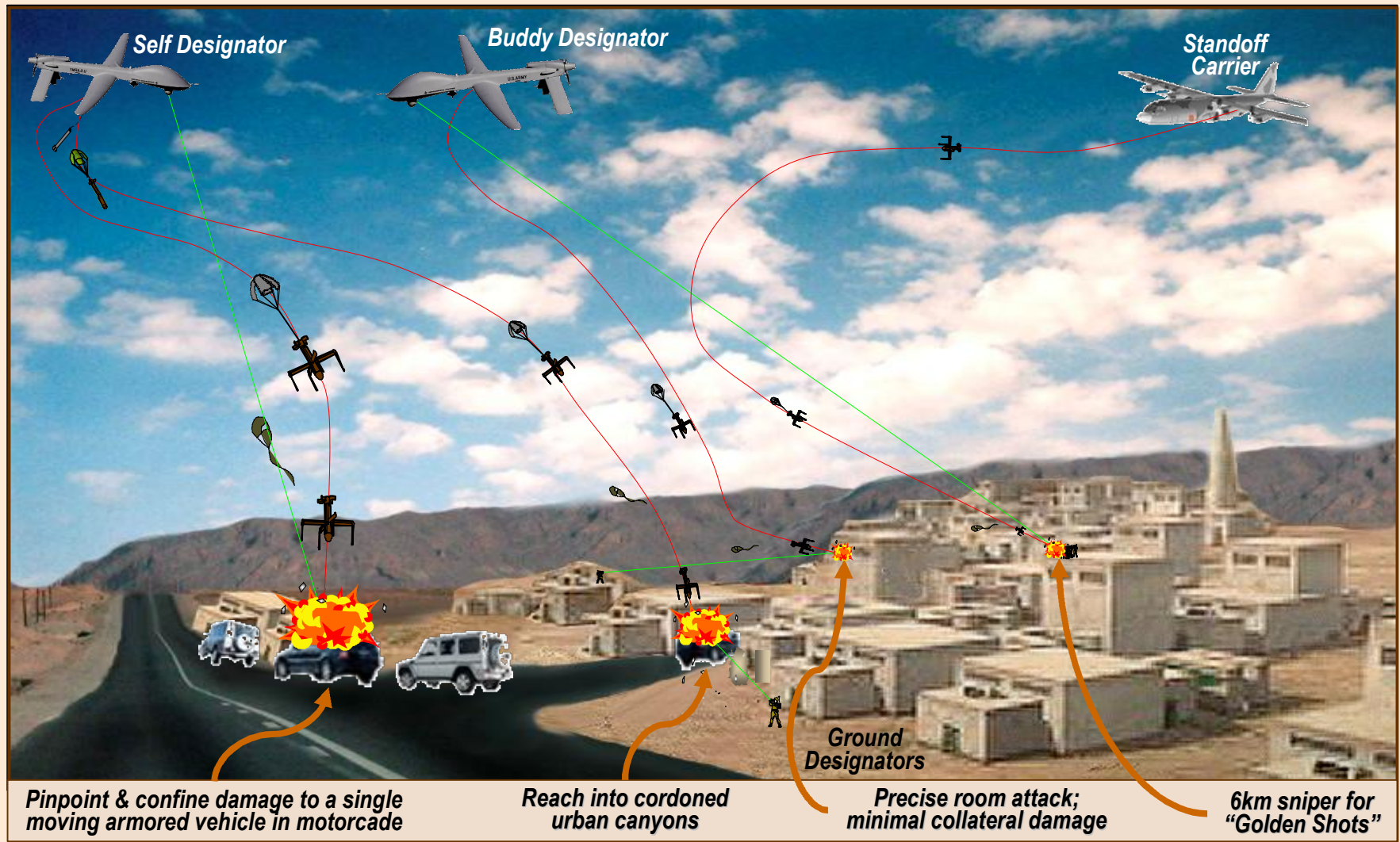
Spiral Improvement Matrix

Funding Candidates for Various Capability Improvements

	• GWOT	• AC-130	• Predator	• Warrior	• SOF	• C-RAM	• DASSP
• GPS Integrated	✓	✓			✓	✓	✓
• Extended Battery	✓	✓					
• Data Link (in-flight)	✓	✓					
• Reduced Weight							
• Reduced Size							
• Frag Warhead		✓					✓
• Height of Burst Fuse	✓	✓					
• Proximity Fuse		✓					
• Platform Integration	✓	✓	✓		✓	✓	✓

Funded with Active Contracts ✓

Future Capabilities





“In every generation, the world has produced enemies of human freedom. They have attacked America because we are freedom’s home and defender. The commitment of our fathers is now the calling of our time.”

President George W. Bush





Precision Strike Review

“PRECISION EFFECTS”

*Air Vice-Marshal **Nigel Day** RAF (Rtd)*
Senior Defence Adviser

PRECISION EFFECTS



- **“Capability”?**
- **UK Air 1915 – 2000**
- **STORM SHADOW**
- **UK Air 2000 +**

PRECISION EFFECTS



- “Capability”?

“CAPABILITY”?

NCW?

NEC?

“CAPABILITY”?

N

E

C

“CAPABILITY”?

NETWORK +

EFFECT =

CAPABILITY

PRECISION EFFECTS



- **“Capability”?**
- **UK Air 1915 – 2000**

NETWORK - 1915



EFFECTS - 1915



UK AIR 1915 - 2000

NETWORK

EFFECT

1915

Basic

Dumb Weapons

UK AIR 1915 - 2000

NETWORK

EFFECT

1915

Basic

Dumb Weapons

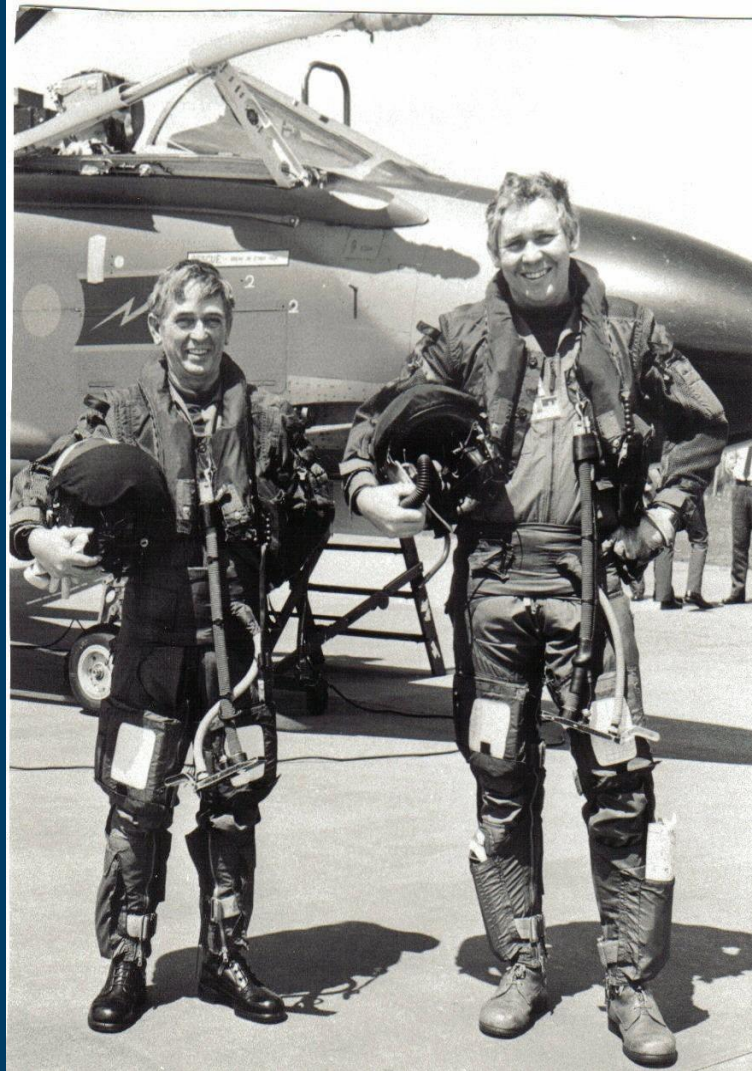
1990

?

?

UK AIR 1915 - 2000

1990



UK AIR 1915 - 2000

NETWORK

EFFECT

1915

Basic

Dumb Weapons

1990

Insecure Radio Dumb Weapons

PAVE WAY PRECISION WEAPONS

- **USA 60s**

- **RAF 80s**



UK AIR 1915 - 2000

NETWORK

EFFECT

1915

Basic

Dumb Weapons

1990

Secure Radio

Dumb Weapons

2000

TDL

Precision Weapons

PRECISION EFFECT

- **The Required Effect, no more, no less**
- **At Required Time, for Required Time, 24/7**
- **Across range of Decisive Opportunities**

PRECISION EFFECTS



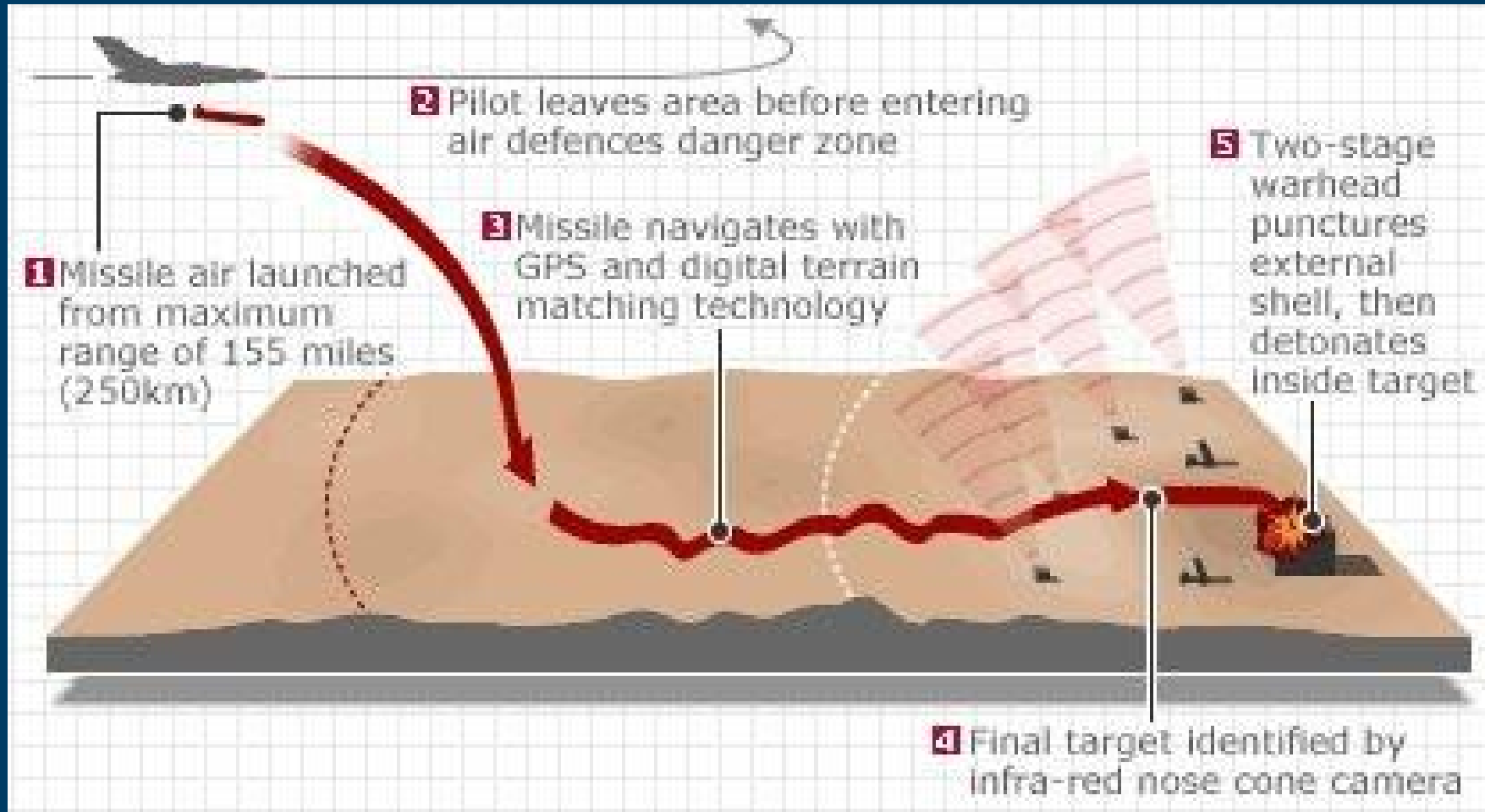
- **“Capability”?**
- **UK Air 1915 – 2000**
- **STORM SHADOW**

STORM SHADOW

2003



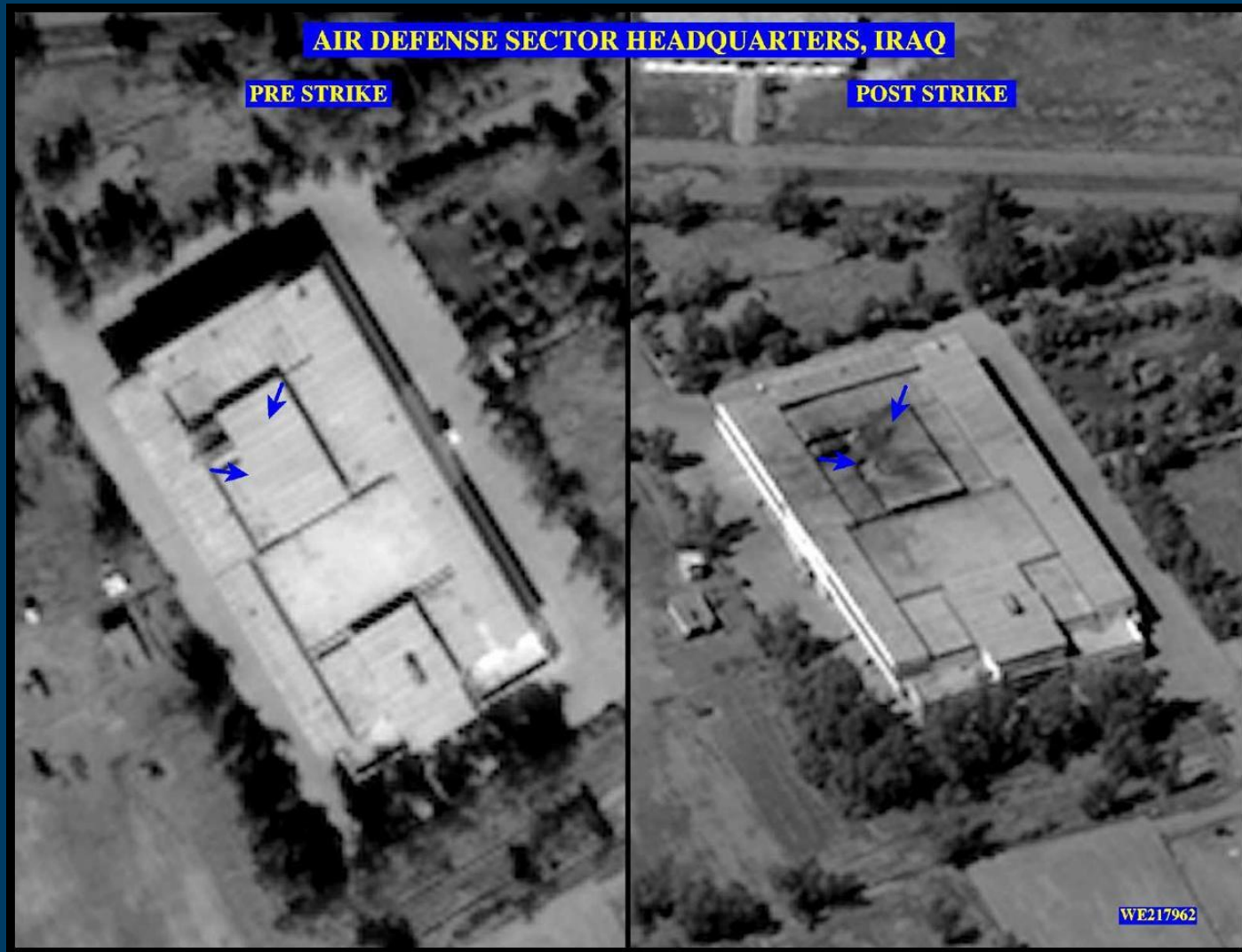
MBDA
MISSILE SYSTEMS



STORM SHADOW



STORM SHADOW



STORM SHADOW

PRECISE EFFECT



2003 Storm Shadow first used in Operation TELIC

STORM SHADOW



PRECISION EFFECTS



- **“Capability”?**
- **UK Air 1915 – 2000**
- **STORM SHADOW**
- **UK Air 2000 +**

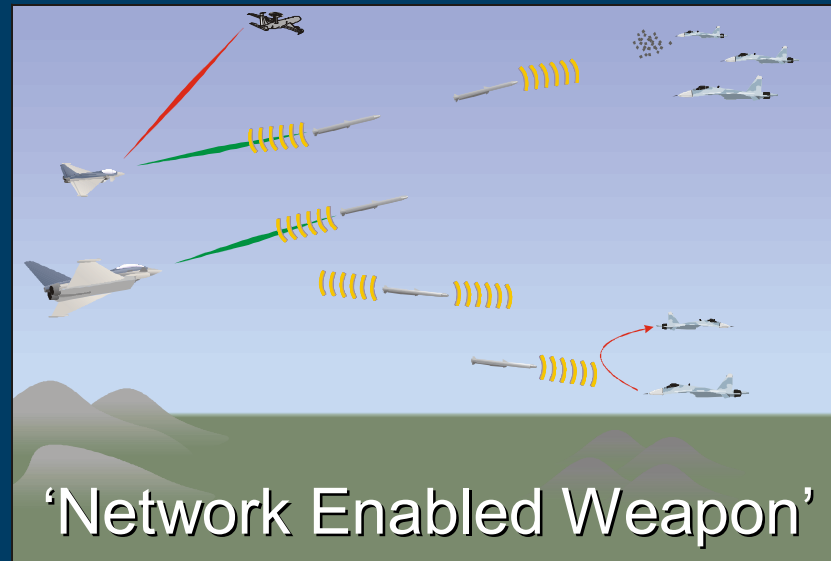
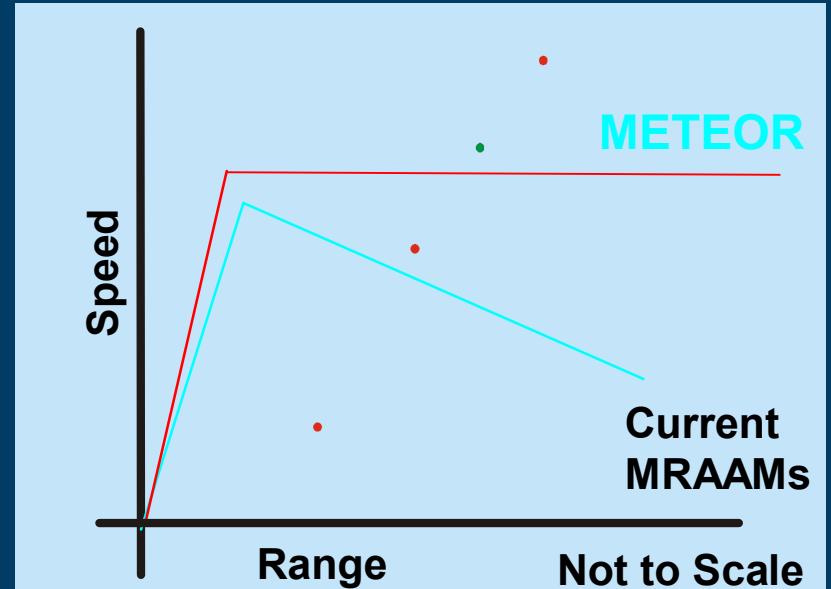
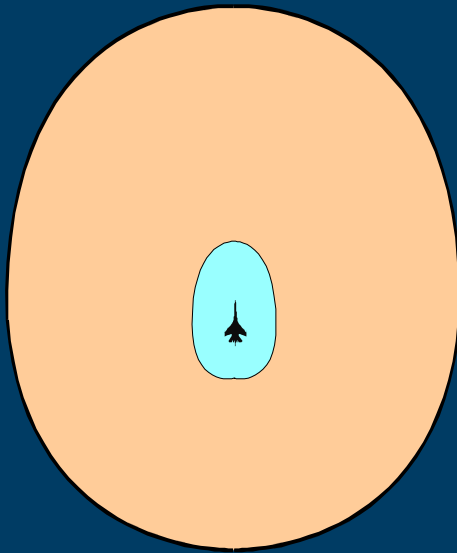
BRIMSTONE 2005



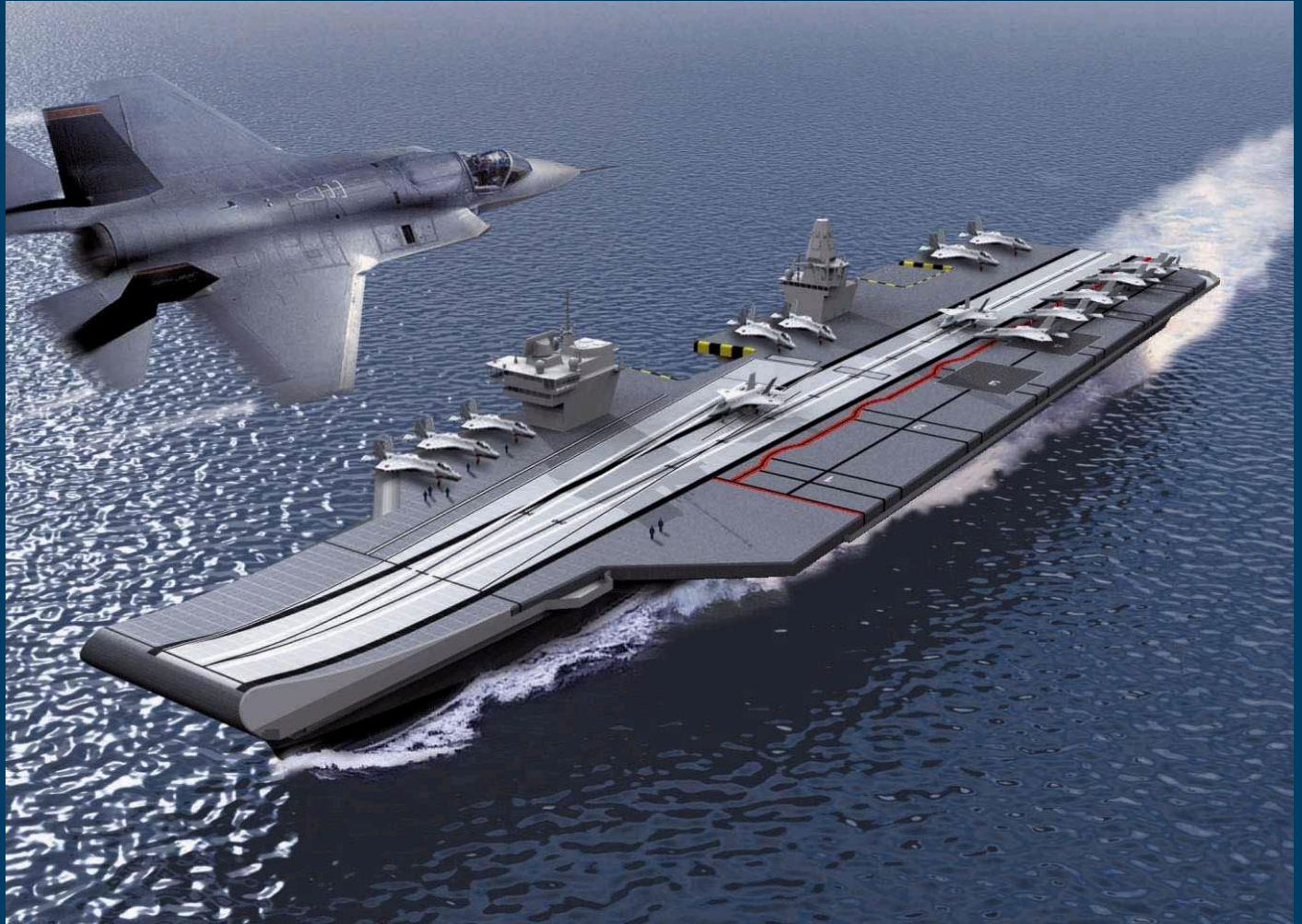
METEOR



No Escape Zone



CV(F)/JCA 2020



NETWORK

EFFECT

1915	Basic	Dumb Weapons
1990	Secure Radio	Dumb Weapons
2000	TDL	Precision Weapons
2006	TDL+	Precision Effects

2020 Precision Decisions, Precision Effects
(< ? Minutes Kill Chain)



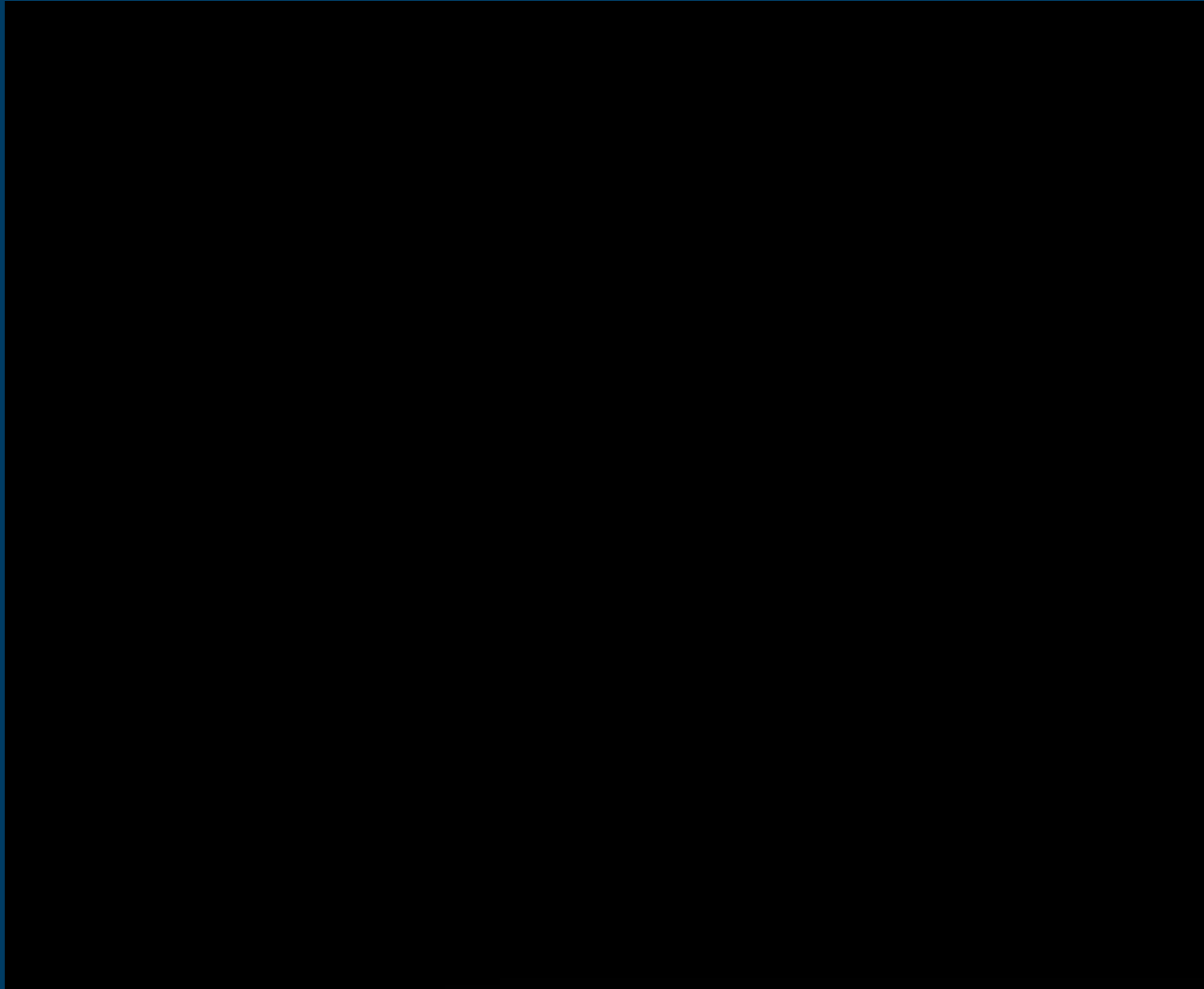
Precision Strike Review

“PRECISION EFFECTS”

*Air Vice-Marshal **Nigel Day** RAF (Rtd)*
Senior Defence Adviser

STORM SHADOW

STORM SHADOW





Precision Strike

Dr. Delores Etter

Assistant Secretary of the Navy

Research Development and Acquisition

19 April 2006



Strategic Environment

- Engaged in the Global War on Terror
- Quadrennial Defense Review
- Fiscal Challenges
(FY07 Budget Submitted
to Congress)





ASN (RDA) Vision

To provide weapons, systems and platforms for the men and women of the Navy/Marine Corps that support their missions and give them a technological edge over our adversaries.





ASN (RDA) Goals

- Expedite GWOT acquisition programs as much as possible without compromising safety.
- Reduce volatility in ongoing and current acquisition programs.
- Develop an investment/transition strategy for Science and Technology (S&T) to ensure future technological edge.
- Lead the Acquisition Enterprise component of the Naval Enterprise, in collaboration with OPNAV/HQMC and the fleet.



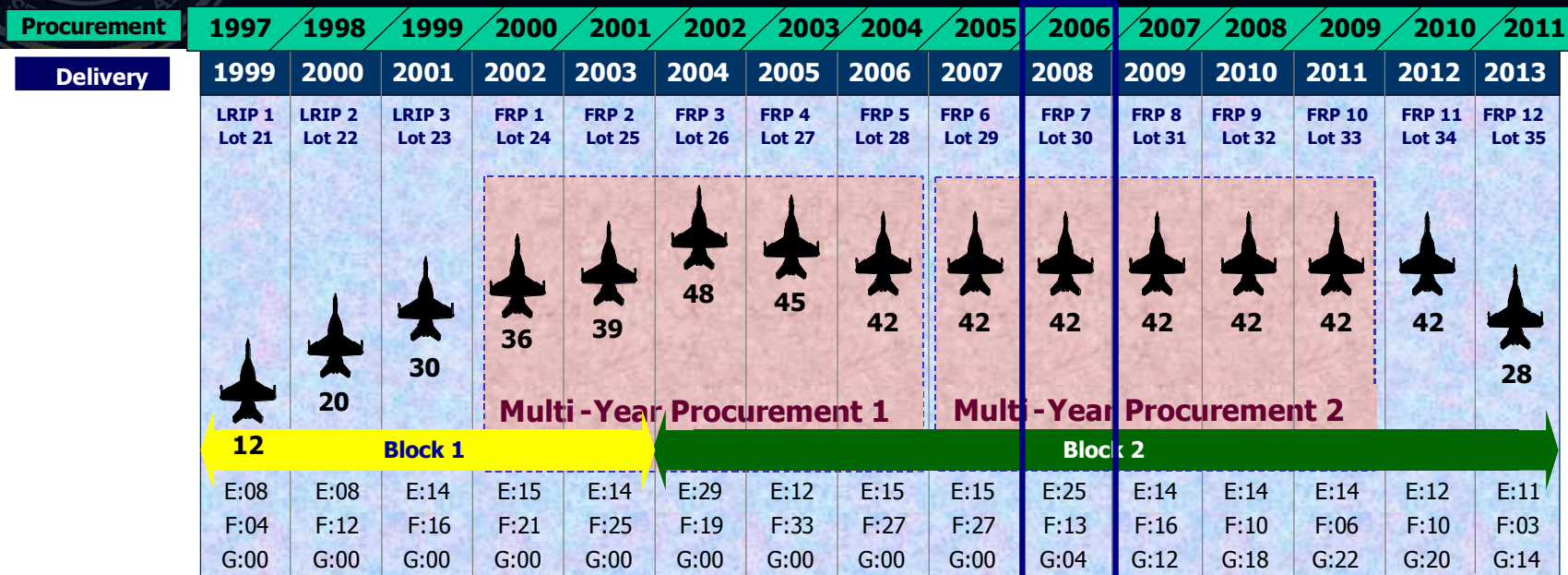


Acquisition Volatility

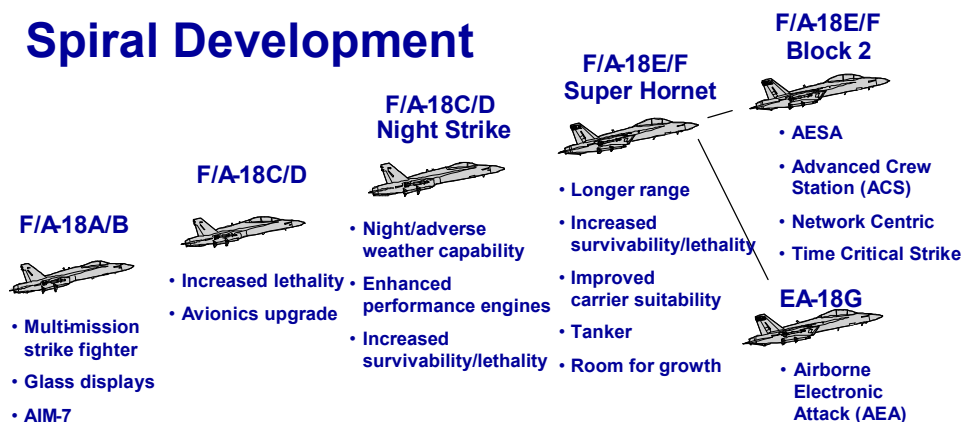
- Definition – tending to vary often or widely
- Program characteristics that affect acquisition program volatility:
 - Program complexity
 - Requirements fluctuation
 - Budget instability
 - Schedule demands
 - Contractor/PM optimism



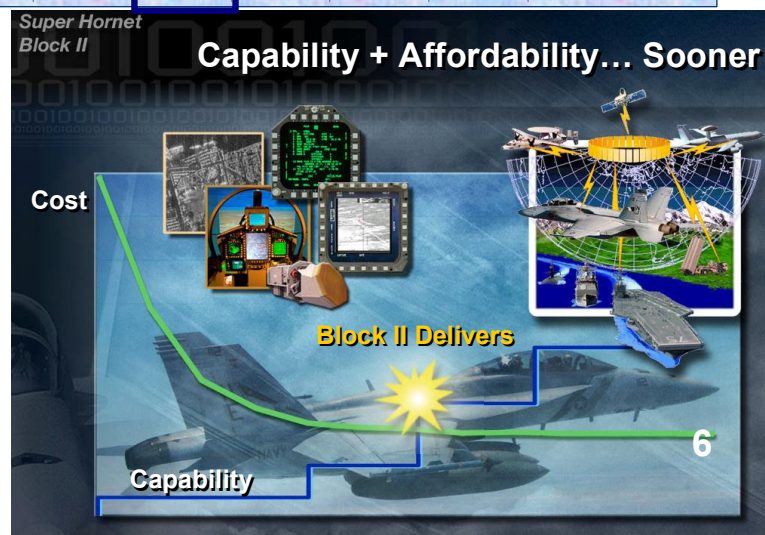
F/A-18E/F and EA-18G Aircraft Deliveries Continue 3 Months Ahead of Schedule and On Cost



Spiral Development



1980 1987 1990 2000 2008

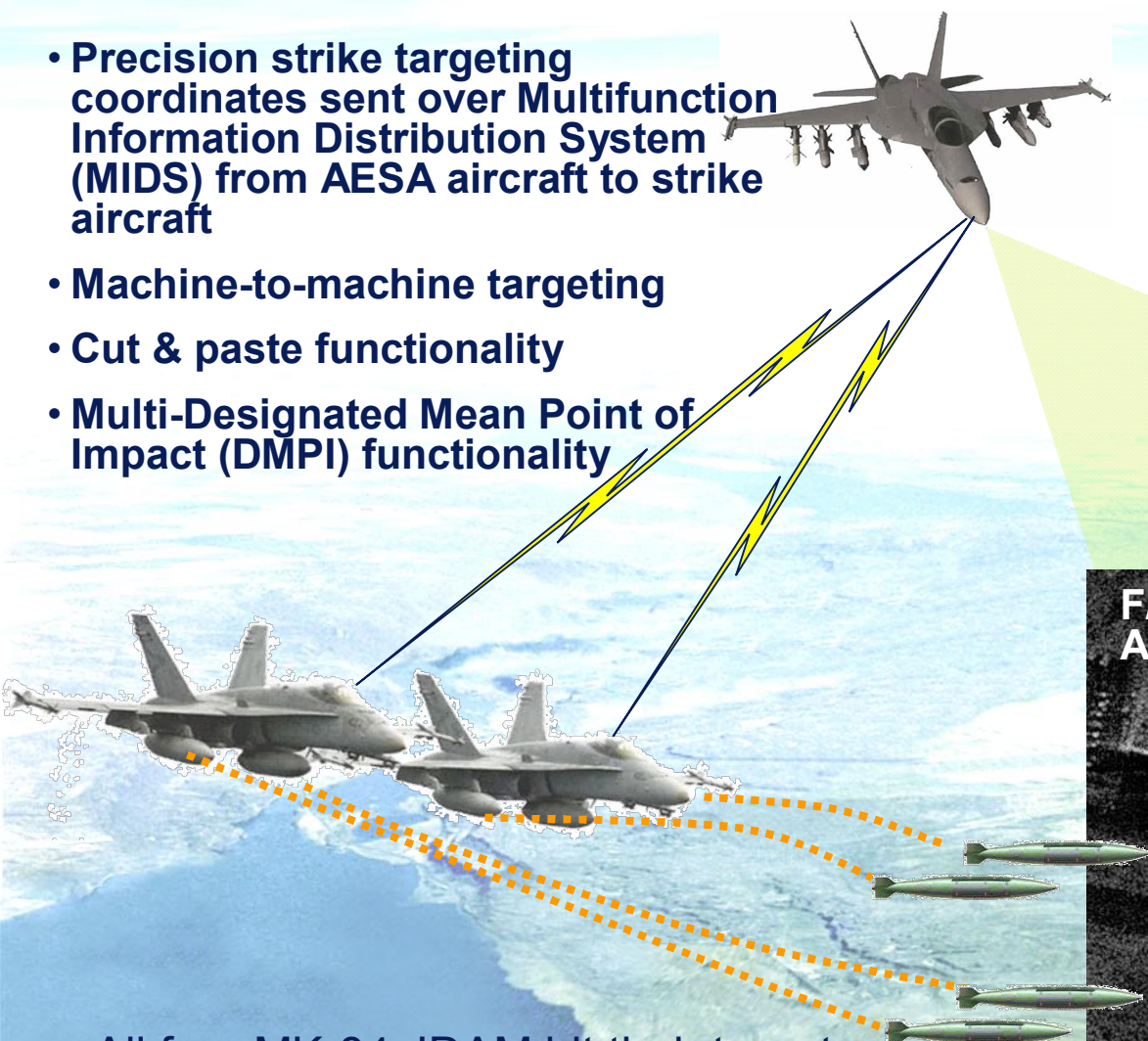


AESA/JDAM/LINK 16

Precision Strike Capability over the Network

- Precision strike targeting coordinates sent over Multifunction Information Distribution System (MIDS) from AESA aircraft to strike aircraft
- Machine-to-machine targeting
- Cut & paste functionality
- Multi-Designated Mean Point of Impact (DMPI) functionality

- Precision self-targeting with AESA radar thru the weather in a network environment
- Successfully tested JDAM standoff range in preparation for AESA OPEVAL
- Integrated weapon system performance!
- AESA operating on a network as a force multiplier



All four MK-84 JDAM hit their targets well within specification limits.



Transitioning DE Technology

*There are few unexpressed thoughts ...
Especially toward the end of the conference.*

Lawrence M. (Mark) Fleenor

505.980.2401

M.Fleenor@SolOriensLLC.com

An Unclassified Presentation



A New Kind Of Weapon From The Pages Of Science Fiction

With A Whole List Of Real or Perceived Issues

Deep Magazine

- Lots of Shots based on Fuel Consumption

Balancing legacy and new requirements

Speed of Light

Misunderstood requirements

Paradigm Shifts

- Immediate attack from tactical to strategic ranges
- Impossible to outmaneuver

Questionable cost-benefit

Precision Engagement

- High value, selectable targets
- Rapid retargeting

Competition with conventional programs

Controlled Effects

- Minimum collateral damage
- Ability to work in a non-lethal effects space

Sketchy direction

A Basic Communications Challenge



Management of Technology Transition

- Balancing Tech push & User pull
- Consciously moving from basic to applied technology development, then refinement and packaging
- Forming and living up to expectations
- Matching capability with requirement
- Crafting demonstration programs
- Showing Military Utility
 - Multi-function / multi-role weapons system
 - Earning a place on a weapons platform

There has not always been a common frame of reference linking Technologists and Warfighters

“Crossing the Chasm” seems a pretty good paradigm for this sort of technology development

A Reasonable S&T Budget

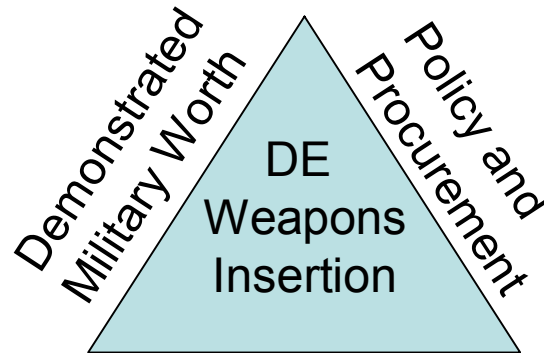
	\$M	FY06	FY07	FY08	FY09	FY10	FY11	06-11 Total	TRL 6 Date
Concept-Guided Technology									
ATL-Spiral 1 (USSOCOM)	61.0	44.0	88.0	75.0	75.0	46.0	389.0	2011	
Airborne Tactical Laser (AF)	11.6	27.9	27.7	27.4	28.5	29.3	152.4	2009	
GBL Counterspace Tech (AF)	8.4	8.7	7.9	8.1	7.9	8.0	49.0	2009	
ABL Tech (AF)	5.2	6.1	6.4	6.7	7.4	8.1	39.9	2005,9	
Relay Mirror Tech (AF)	7.8	8.7	8.5	8.4	8.4	8.6	50.4	2014	
Laser Technology Prog (MDA)	43.5	48.1	48.8	50.4			190.8	2006,7	
Ground Mobile Tactical HEL (Army)	29.1	35.4	41.5	47.6	47.4	50.5	251.5	2015	
Ground Mobile Electronic Attack (Ar)	9.0	14.4	22.0	18.6	10.6	11.0	85.6	2012	
Countermine/Counter IED (Army)	6.1	7.7					13.8	2007	
Vehicle Stopper/Area Denial (Army)		4.2	10.7	18.2	12.7	9.5	55.3	2012	
Anti-Sensor Tech (AF)	10.4	4.2					14.6		
Airborne Electronic Attack (AF)	17.4	17.8	17.7	18.6	18.9	19.2	109.6	2012	
Airborne Active Denial (AF)	11.4	17.4	14.8	12.9	4.9	5.0	66.4	2011	
FEL Scaling (Navy)	10.0	10.0	10.0	10.0	10.0	10.0	60.0		

...and Some Demo Programs

DE System Development Programs	FY06	FY07	FY08	FY09	FY10	FY11	06-11 Total	Demo Date
Airborne Laser (ABL) (MDA)	555.0	609.0	471.0	454.0	461.0	470.0	3020.0	2008
Advanced Tactical Laser ACTD (USSOCOM)	61.0	12.0					73.0	2007
Active Denial System ACTD (JNLWD)	4.3						4.3	2005

How Do You Get DE into DoD Inventory?

Established Need
Military Worth Assmt.
Capability Awareness
Measured Robustness
Measured Effectiveness
CONOPS
BDA-effect verification
Favorable Cost/Benefit
Training and Logistics



Technology Development

Funding
•S&T
•ACTD
•Directed
•POM
Human Effects
•Enemy
•Friendly
•Noncombatant
JAG Review
Policy Matters
T & E

*Some Claim
They've Done It*

*Applicability
Maturity
Attribute Mix
Show Effectiveness*

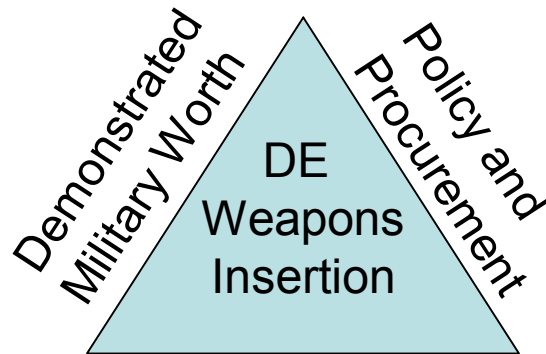
*Some Claim It's
Impractical or
Impossible*

Does This Look Like Any Other Hi-Tech Weapons Program ?

So What's Harder About Fielding DE?

Established Need

Military Worth Assmt.
Capability Awareness
Robustness
Effectiveness
CONOPS
BDA-effect verification
Favorable Cost/Benefit
Training and Logistics



New Start

- ACTD
- Directed
- POM

Human Effects

- Enemy
- Friendly
- Noncombatant

JAG Review
Policy Matters
T & E

Technology Development

*There is still a basic
tech maturity and
product
development
timeline*

*Applicability
Maturity
Attribute Mix
Interoperability
Show Effectiveness*

**There are some recent
Transition success stories**

Evidence of Forward Progress

– as measured by recent talks at DEPS

- DE Bio-effects Overview
- Active Denial Program
- RF DE Against IED
- The NIRF System
- SPARROW Portal Protection System
- HPM Counter-Manpads Effects
- Models and Predictive Capabilities for Assessing Computer Systems
- Round-to-round Comparisons of Susceptibility Measurements for a Missile Seeker
- Vehicle Engine Stopper Historical efforts Summary
- DTRA Counter-HPM Program
- Virtual Prototyping of an HPM System



Success Path

- Continuing to target mature, useful technologies with an arguable case for military worth – and a committed early-adopter for the military capability
- Adeptness at matching non-conventional war-fighter requirements to appropriate DE Solutions
- Continuing advances in BDA, user confidence, and budget/ policy acceptance
- Executing compelling military worth demonstrations with clear and reasonable evaluation criteria
- Technology transition with appropriate emphasis on –ility issues
- Technology insertion, weapons system procurement, and fielding

Adaptability and Some Measure of Patience are Required

Summary

- Transition - Not Easy but Doable
- Steady advances in technology, military worth, and policy
- DE in sensible niches
- Patience and adaptability
- Enough experience to take the long view

Small Diameter Bomb



Small Diameter Bomb Increment I

(SDB I)

Precision Strike Association Annual Program Review

19 April 2006

Col Dick Justice
Commander,
Miniature Munitions Systems Group
richard.justice@eglin.af.mil



SDB Increment I

GBU-39/B, BRU-61/A



Small Diameter Bomb

Mission:

All-weather, Autonomous, Precision Strike
Decrease Collateral Damage

Increased Loadout for Multiple Strikes Per Sortie at Standoff Ranges



Description:

IM Compliant 250 Lb Class Multipurpose Warhead

Diamond-back Wing Provides Increased Range

4-place Pneumatic Carriage System

Cockpit Selectable Electronic Fuze - Impact, Height Of Burst, & Delay



Guidance:

INS/GPS Augmented by Differential GPS

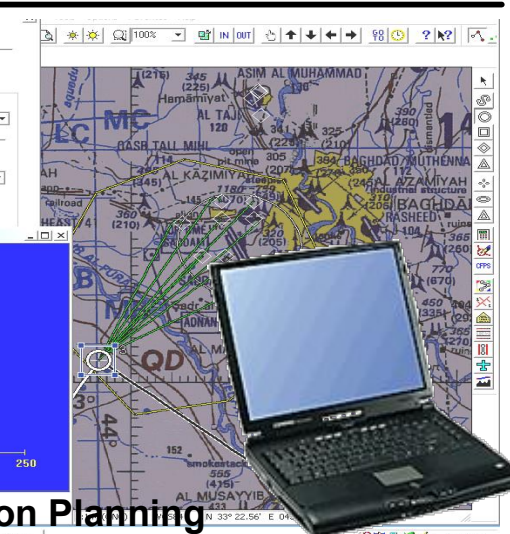
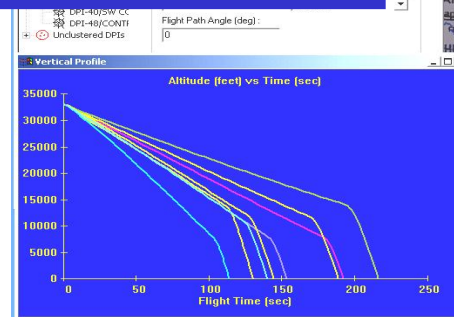
Anti-Jam GPS with SAASM

Platforms:

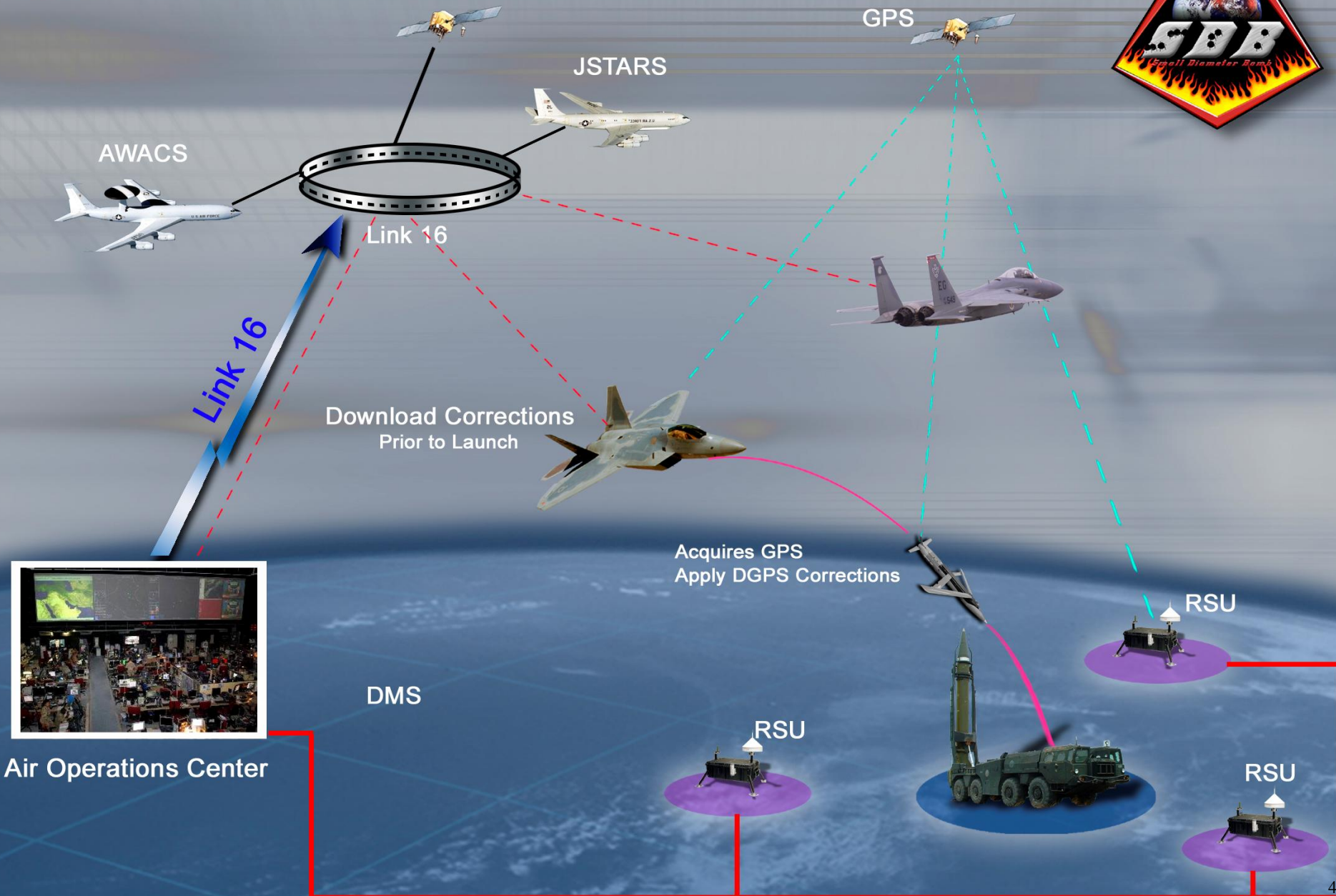
Threshold: F-15E

Objective: F-22A, F-35, F-16, F-117, A-10, B-1, B-2, B-52, MQ-9





SDB Accuracy Support Infrastructure





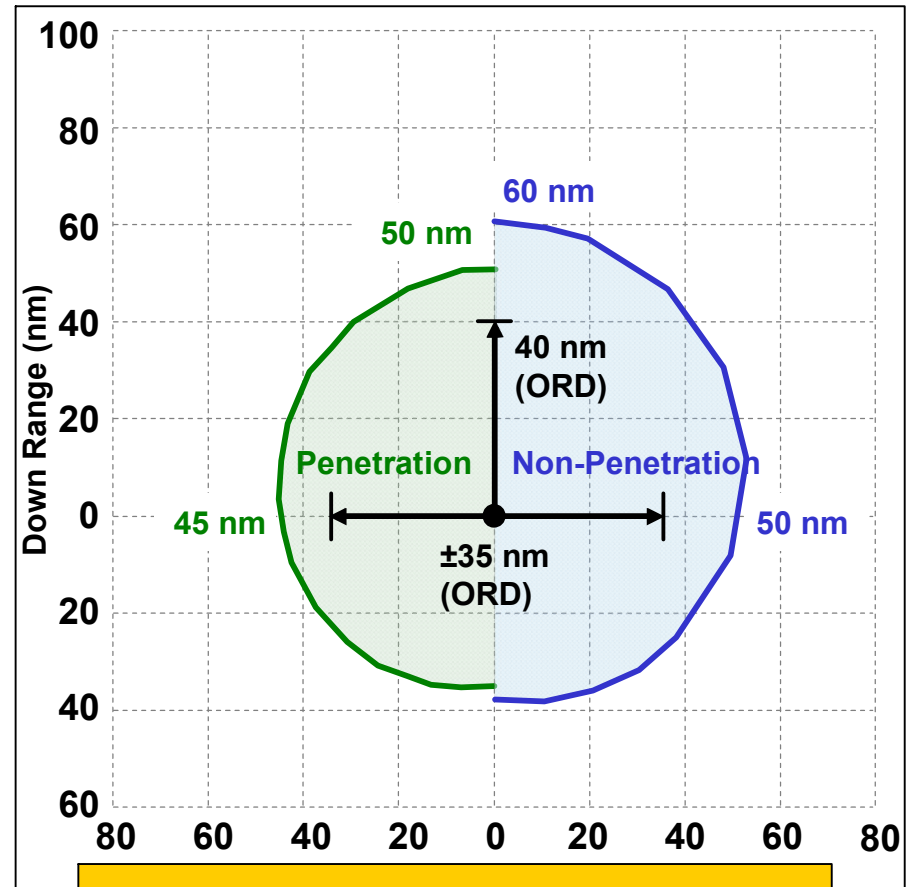
Increased Loadout / Standoff



Small Diameter Bomb



4 Weapons per 1760 Station



Standoff Ranges of 40nm+

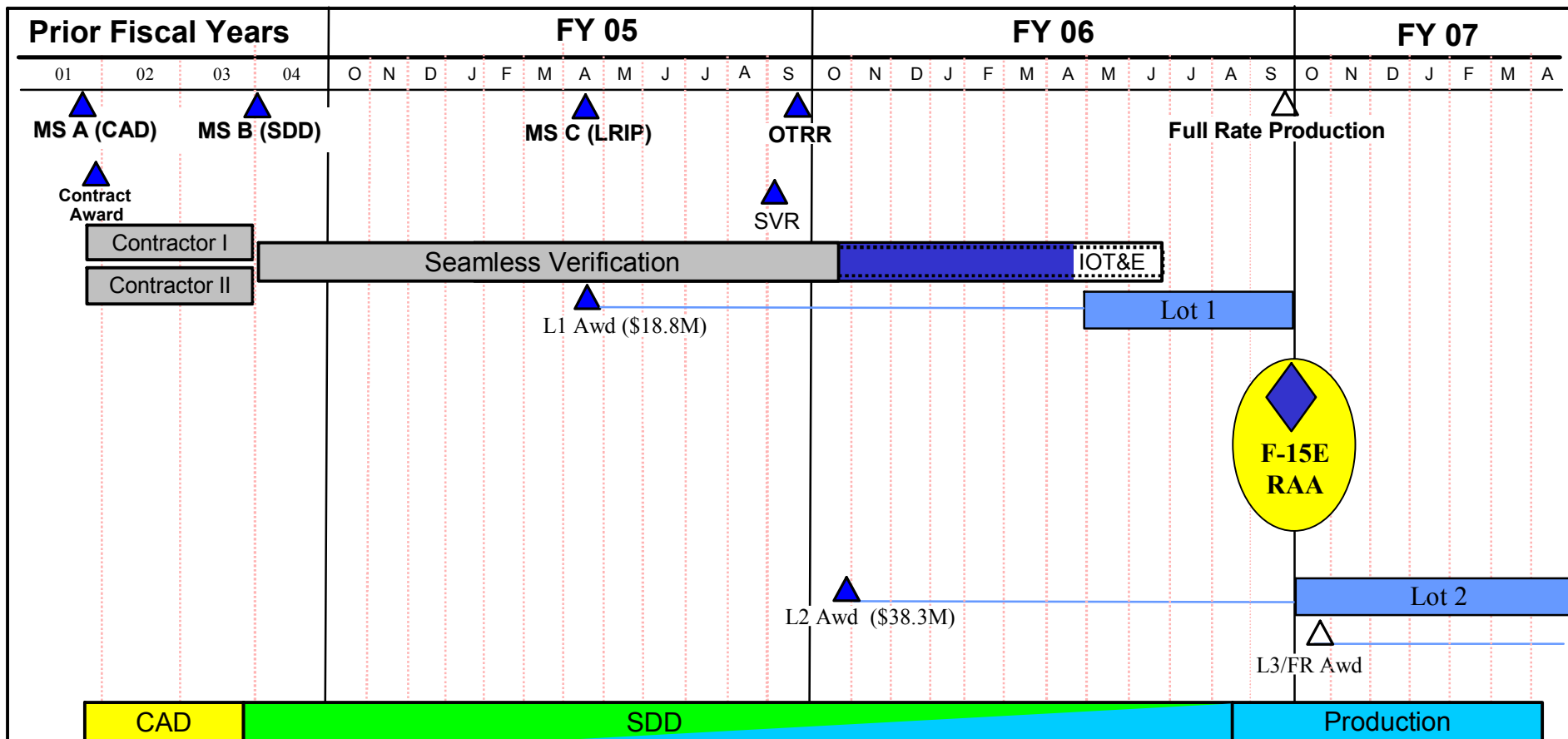
Loadout Balanced vs Weapon Effects: 250 lb Class SDB I

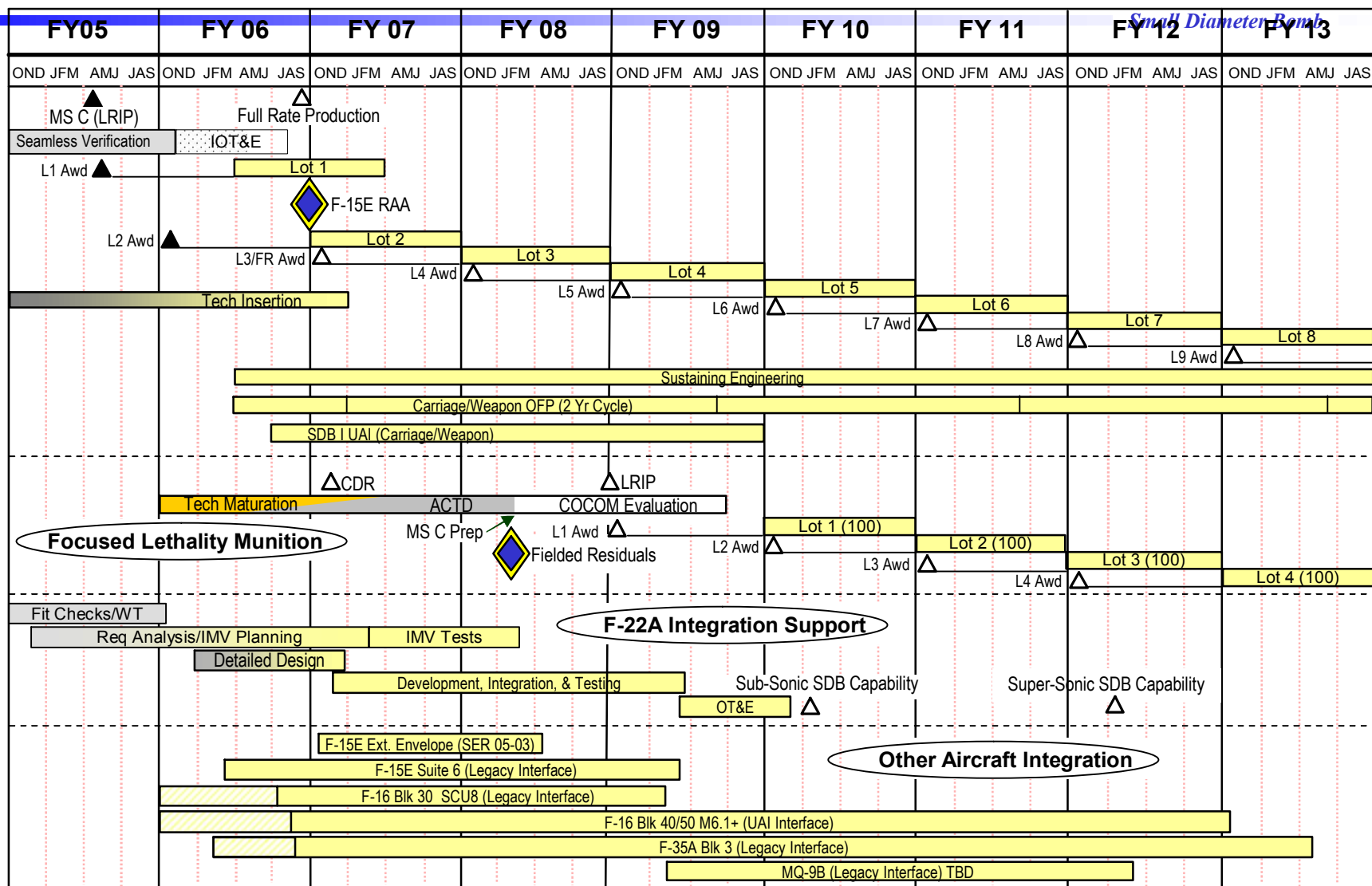


SDB I Schedule



Small Diameter Bomb





Pre-Contract Work

Integrity – Service - Excellence



History...Why SDB I?



Commander's Intent: You Will Deliver Small Diameter Bomb (SDB) to the Warfighter in FY06. Schedule Is Paramount

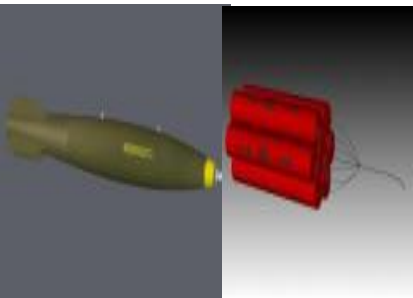
Small Diameter Bomb



- Fewer Aircraft
- Fewer Crews
- ...More Effect from Less



- Diminishing Sources
- Changing Laws, Ops



- Tactics
- Laws of Armed Conflict
- "Combat" JAG

- Global News Coverage



- ✓ Increase Number of Kills Per Pass
- ✓ Enhance Weapon Stand-off Range
- ✓ Combat Effective in Adverse Weather
- ✓ Provide Weapon Penetration Capability
- ✓ Minimize Collateral Damage
- ✓ Provide Autonomous Target Attack
- ✓ Reduce Logistics Footprint
- ✓ Reduce Aircraft Generation Times
- ✓ Achieve Battlefield Effects Against
 - ✓ Fixed Covered,
 - ✓ Fixed Concealed,
 - ✓ Fixed Hardened

(JROC: Feb 2005)



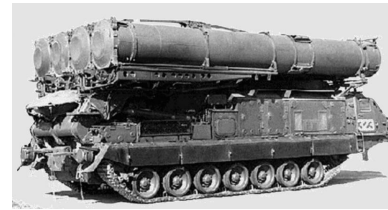
SDB I Target Set



- **C3 Sites**
 - Communication Facility
 - Antenna, Park Drive SATCOM
- **Air Defense Sites**
 - Radar, Revetted, EW/GCI Site
 - Radar, Grill Pan
- **POL Sites**
 - POL Refinery
 - POL, Large Partially Underground Tanks
- **Airfield Targets**
 - Aircraft, Fighter – Revetted
 - Aircraft Shelter, Large Concrete Arch
 - Airfield Maintenance Complex w/ Machine Tool



Bomb





SDB I Target Set (Con't)



Small Diameter Bomb

- **Infrastructure Targets**

- Transformer Yard



- **Missile Sites**

- SCUD Missile in Travel Mode, Stationary
- BM-21 Rocket Launcher, 122mm, Stationary



- **Artillery Sites**

- ARTY, 152mm Towed Field Gun/Howitzer



- **AAA Sites**

- ZSU-23-4, Stationary

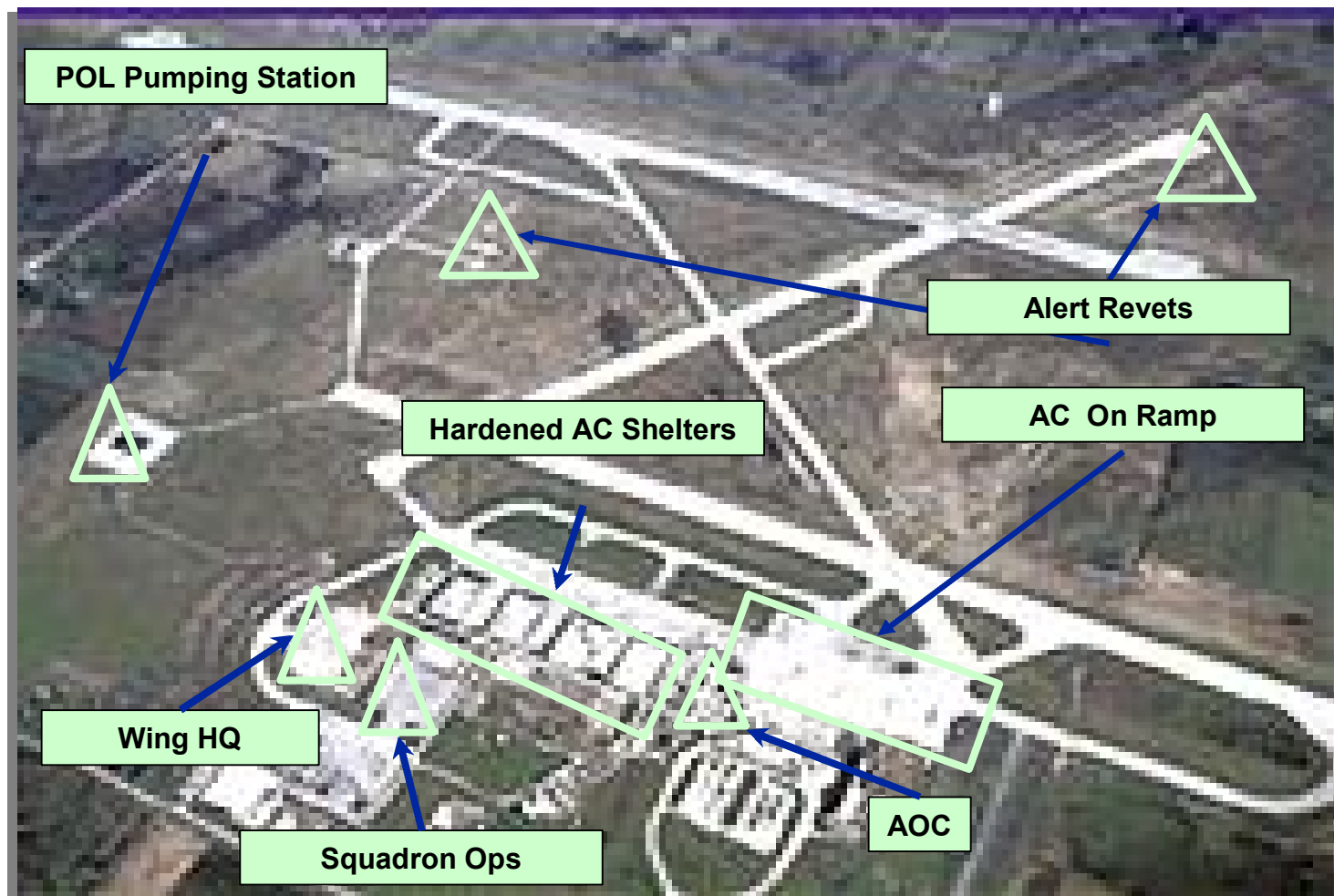




One F-15E Loadout with SDB I Kills This Airfield... Single Sortie



Small Diameter Bomb





“Small” Can be Lethal



Small Diameter Bomb

- **MMTD Warhead**
 - Small, Well-Placed, Well Designed Warheads Do Damage



- **SDB I Size Warhead Test**





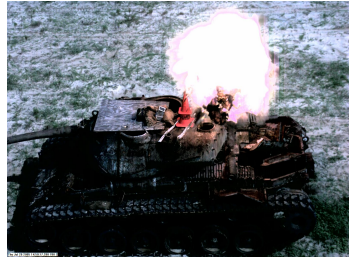
SDB I Test Status



Small Diameter Bomb

- **Development Portion of Seamless Verification Complete**

- 35 for 37 Successful Flight Tests (CAD & SDD)



- Insensitive Munitions Testing Completed
- IM Certified by AF



Bullet Impact



Fragment Impact



Slow Cook-Off



Fast Cook-Off



Sympathetic Detonation

- Operational Testing Ongoing



SDB I Executive Summary



Small Diameter Bomb

KPPs		
<i>Requirement</i>	<i>Criteria</i>	<i>Status</i>
Weapon Loadout	4 SDB Weapons per SDB I Carriage	✓
Net-Ready (GPS Interoperability)	100% of Top-Level IERs Designated Critical. NAV Data From GPS to SDB I	✓
Thresholds		
<i>Requirement</i>	<i>Criteria</i>	<i>Status</i>
Range (40kft, 0.8m)	40nm	50nm
Weapon Effectiveness	17 Weapons for 14 Targets	15 for 14
F-15E Integration	4QFY06 RAA	✓
AUPP Cost of \$64K (BY01\$) (\$41K Objective)	<u>\$(24,000 Weapons) + \$(2,000 Carriage Systems)</u> 24,000 Weapons	< \$30K
A/C Loadout	F-15E - 12 Weapons F-22A - 8 Weapons	✓



SDB I Meeting Commitments

On Track for RAA 4QFY06



Small Diameter Bomb



BRIMSTONE

The Royal Air Force's New Precision Strike Weapon



Squadron Leader Jim Mulholland
31 Sqn's Weapons Leader

Aim

- Leave you with a lasting impression of the capability of the Royal Air Force's latest precision strike weapon
- BRIMSTONE.



Classification



Scope

- Capability Gap
- BRIMSTONE
- Evaluation
- The Future
- Summary.

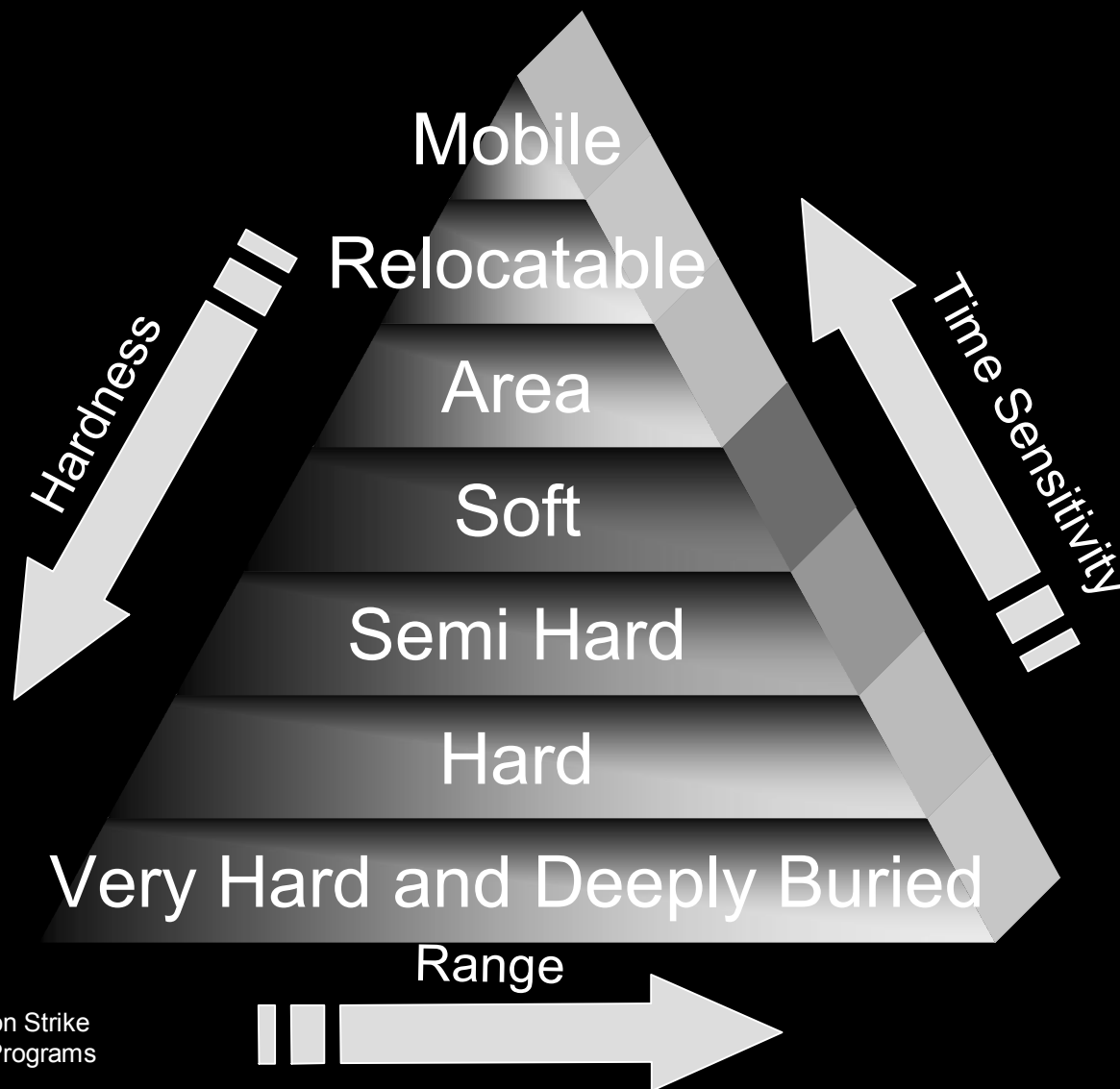


Scope

- Capability Gap.

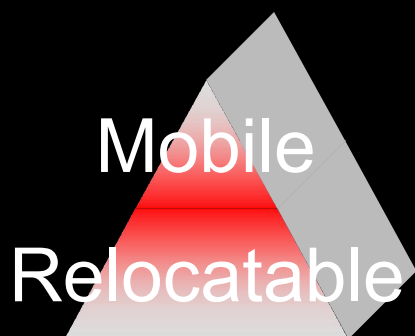


Capability Gap

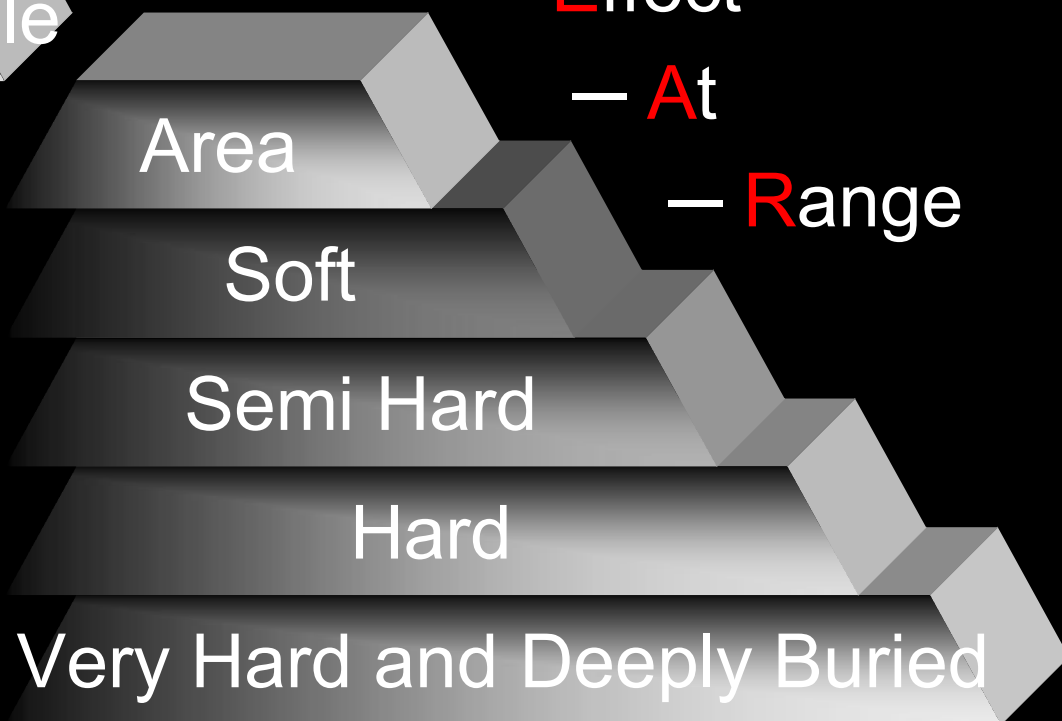


Capability Gap

- **Selective**
 - **Precision**
 - **Effect**
 - **At**
 - **Range**



- Precision
- Effect
- Time
- Range
- Low Collateral
- Interoperability
- Growth Potential



Capability Gap

- Precision ✓ Yes
- Effect ✓ Yes
- Time ✓ Yes
- Range ✓ Yes
- Low Collateral ✓ Yes
- Interoperability ✓ Yes
- Growth Potential ✓ Yes.



Scope

- Brimstone:
 - Requirements
 - Overview (seeker, missile)
 - Employment
 - Attack Mode
 - Video Simulation.



Brimstone Requirements

- Minimum Crew Workload
- Autonomous / Fire and Forget
- Multiple Kills per pass
- All weather / 24 Hour operation
- Modular to ease growth potential
- Currently highly effective against a wide variety of:

APCs



ADUs



SPGs

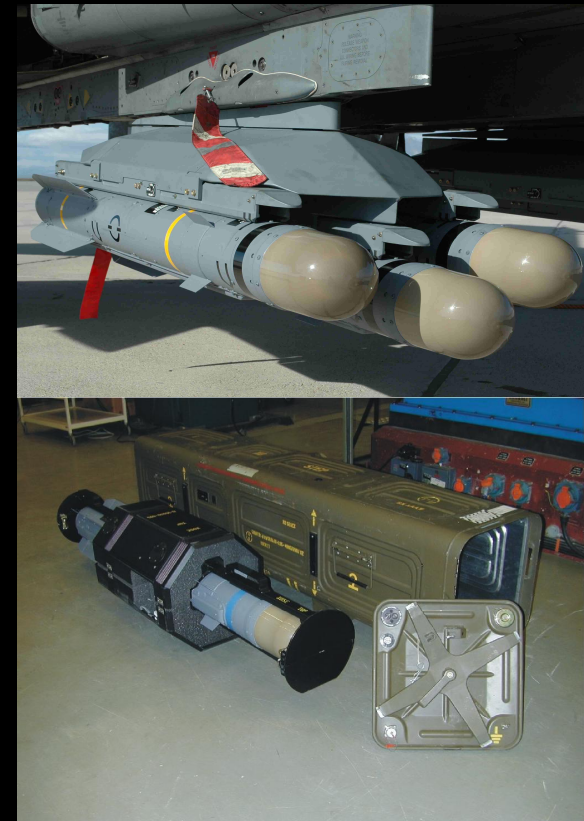


MBTs



Brimstone

- Weapon Comprises:
 - An All Up Round from the container
 - A re-useable 3 rail 1760 launcher
 - Up to 3 Missiles per Salvo
 - Up to 12 Missiles per jet
 - Built In Test.



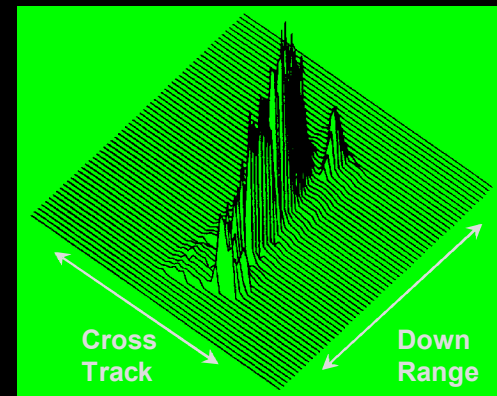
Brimstone

- Designed to:
 - Defeat armoured targets
 - Launch from high speed fixed wing
 - Multiple or single missile firing
 - Supersonic cruise
 - 3 attack scenarios.



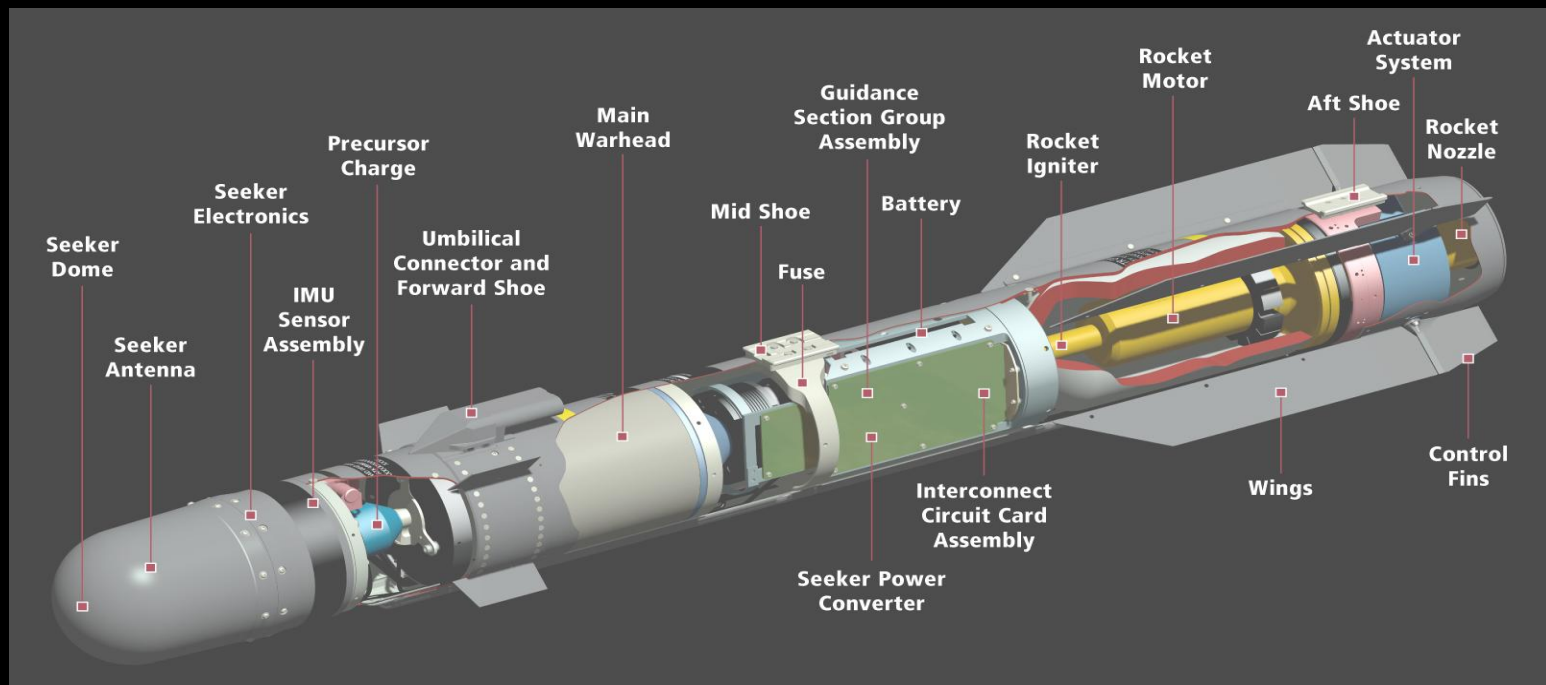
Brimstone Seeker

- Active 94 GHz FMCW radar 'push-broom'
- Autonomous / Fire and forget capability
- All weather / night
- Terrain avoidance
- Real time target detection and classification.



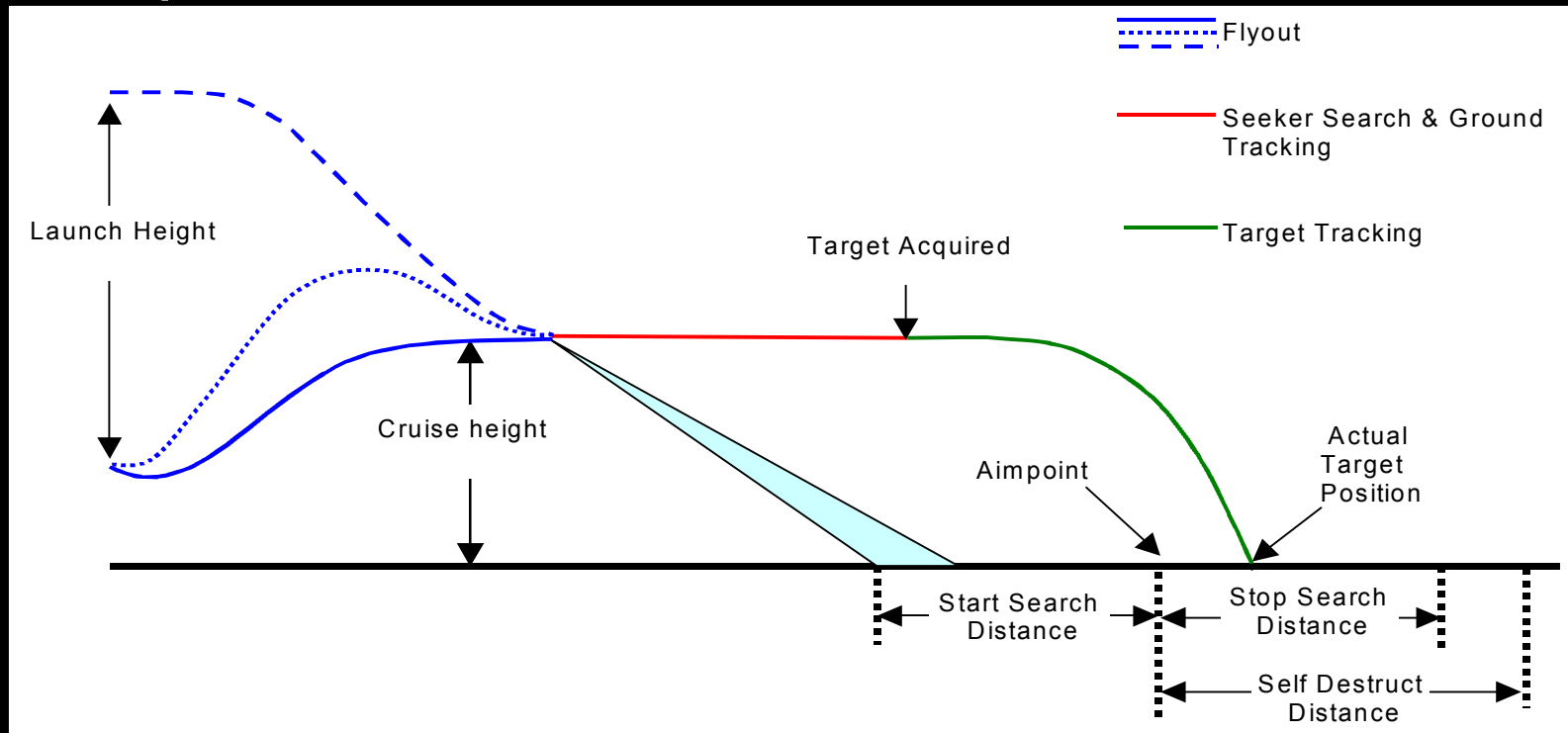
Brimstone Missile

- Mass, electrical and mechanical external interfaces are all similar to the Hellfire Missile
- Operation in a high speed environment .



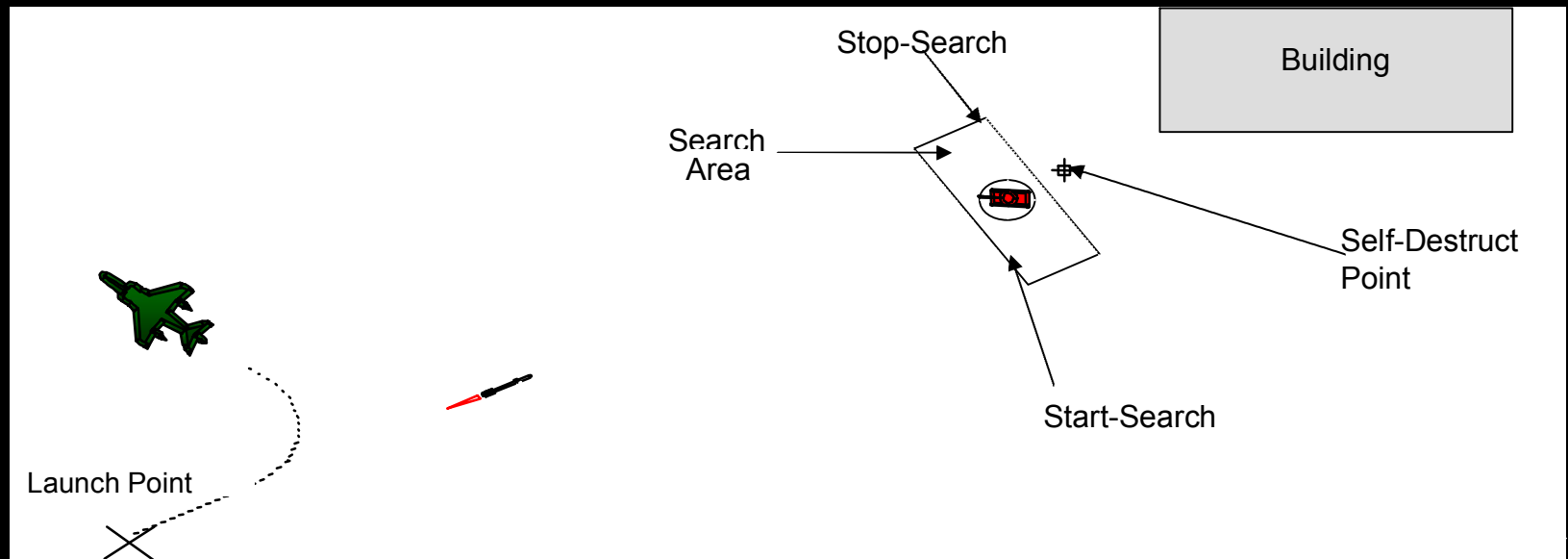
Brimstone Employment

- Manual data entry - future
- Target position (Lat, Long, Alt), start search, stop search, self destruct, attack mode.



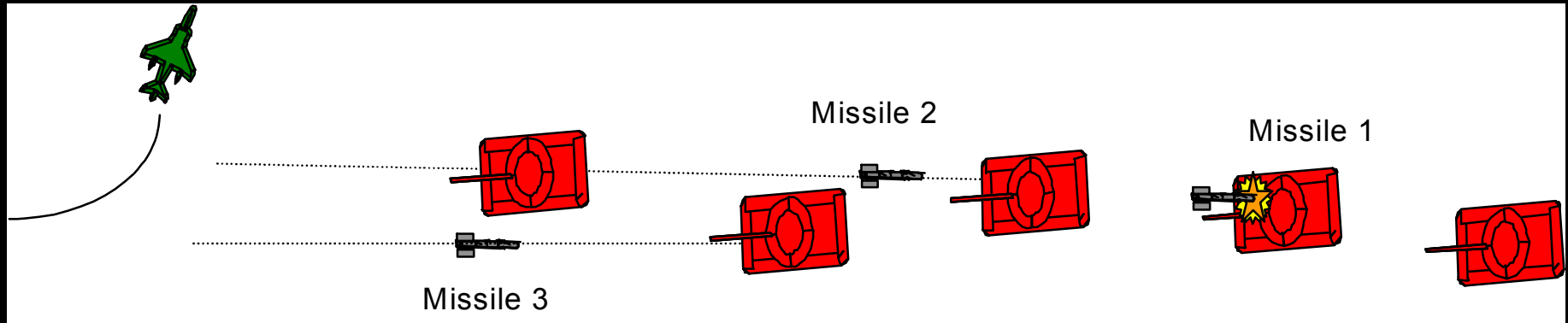
Brimstone Attack Mode

- Point Attack:
 - Select number of missiles
 - Search in the same area – self destruct
 - Direct or indirect.



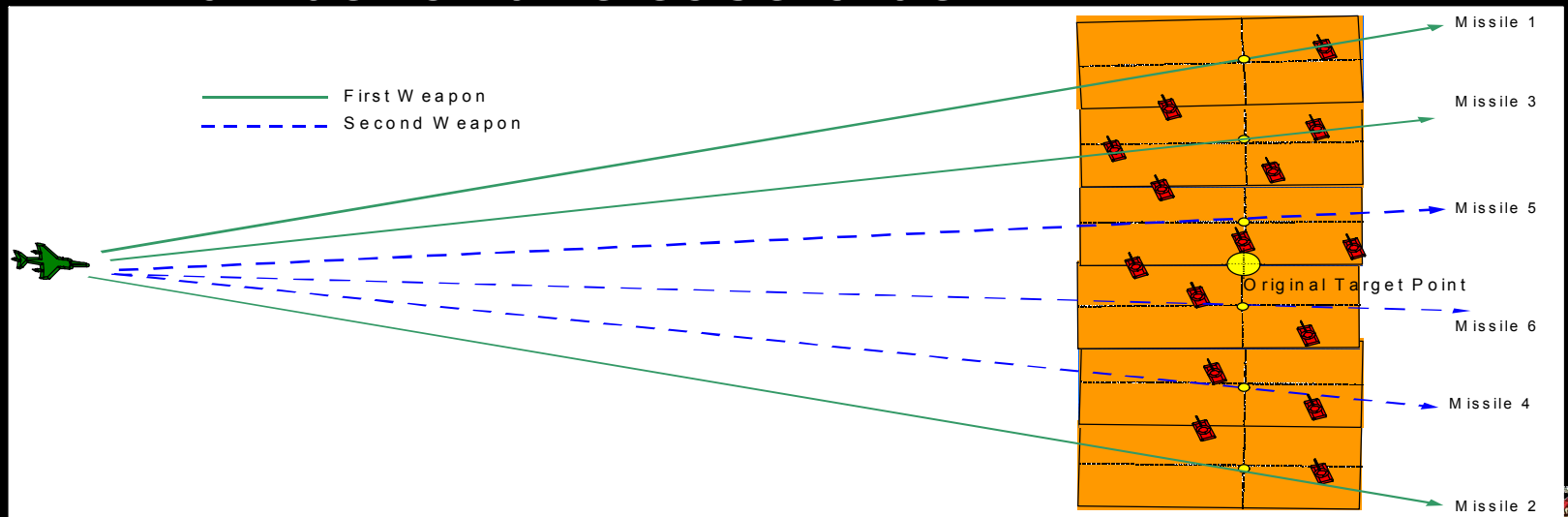
Brimstone Attack Mode

- Column Attack:
 - Select number of weapons - 3 or 6 Missiles
 - Each missile engages nth target
 - Dependent on the number of weapons and the release order.



Brimstone Attack Mode

- Area Attack:
 - Select 1 to 4 weapons - 3 to 12 Missiles
 - Missiles generate different target search areas based on target position, weapon number and release order.



Brimstone Video Simulation



18 April 2006 Precision Strike
Association Annual Programs
Review

UNCLASSIFIED



Scope

- Evaluation.



Evaluation

- Between Jan to Dec 2005 evaluation, and acceptance trials
- IOC Mar 2005, FOC Dec 2005
- Extensive RAF Service Evaluation Trials:
 - All attack modes
 - Stationary and moving targets
 - Single missile and weapon salvos
 - 22 missiles fired, 21 hits
- Mature, capable and rigorously tested.



Scope

- The Future.



The Near Future

- Now available as a weapon of choice for Operations
- Apr 06 - full integration in a SEAD scenario, 'Sensor to Shooter'
- Evolution of the Tornado employment tactics against SEAD defences
- Brimstone DEAD?



The Future

- Sea trials have confirmed tracking capability
- Naval target arrays:
Boghammar, Boston Whaler, Zodiac H1010, Future Catamaran
- Seeker Algorithms:
 - DEAD, sea targets, urban environments, man made structures.



The Future

- Insensitive Munitions
- Increased range
- Data Link



Scope

- Summary.

18 April 2006 Precision Strike
Association Annual Programs
Review

UNCLASSIFIED



Summary

- ✓ Precision
- ✓ Effect
- ✓ Time
- ✓ Range
- ✓ Low Collateral
- ✓ Interoperability
- ✓ Growth Potential
- ✓ Snipe to Area
- ✓ ERA
- ✓ Simple + Supersonic
- ✓ Out of danger
- ✓ Minimal
- ✓ Fast-Jet Proven
1760 – US ahead
- ✓ Modular Incremental
 - ✓ This is already a production Missile



Summary

- Thomas Edison:
“There is a way to do things better - find it”
- Air Chief Marshal Sir Jock Stirrup:
“In the early days of my career it would have taken 21 jaguar aircraft bombers to take out a single Soviet tank. Now one aircraft equipped with Brimstone could take out a dozen tanks”
- If you are still unsure or are considering a career operating for an opposing force inside an armoured vehicle



This tank had all explosives and combustible fluids removed and it was still burning 8 hrs after being impacted by BRIMSTONE...



Do you have any questions?

The End



Squadron Leader Jim Mulholland
31 Sqn's Weapons Leader



Joint Combat Operations

MG David C. Ralston
Chief of US Army Field Artillery



Agenda



- ***Joint Fires Training***
- ***Joint Precision Targeting***
- ***Precision Munitions***
- ***C-RAM***



Joint Operational Fires and Effects Course



No "Single" Service School Established to Train Fires & Effects Above the Brigade Level (Lethal and Non-Lethal) in Support of the Joint Force Commander.

Ft Sill Developed Joint Operational Fires & Effects Course (JOFEC) Sep 04

5 Courses taught to date, Scheduled 4 x per Year (Anticipate 8) with 30 students per course

Focuses on Operational Level Fires & Effects

Emphasizes both Lethal and Non-Lethal Fires & Effects, IO, Space and EBO

Recent innovations include Counterinsurgency and Coalition Issues as topics



Joint Operational Fires and Effects Course



In JFCOM Course Catalog

Overwhelming Request for Attendance; Extensive Waiting List

Attendance breakout—14 Army, 4 USAF, 4 USMC, 4 USN, 4 SOCOM

Desired End State: Highly Trained Joint Service Members Capable of Flawlessly Integrating and Executing Joint Fires & Effects in Support of the JFC



Joint Fires Observer (JFO) Concept



Army has Identified the Need for increased Terminal Attack Control Capability. Air Force is Increasing JTAC Structure Beginning FY06.

Army-Air Force-SOCOM JFO MOA Signed (Nov 05).

JFO Definition Approved – “ A trained service member who can request, adjust, and control surface-to-surface fires, provide targeting information in support of Type 2 and 3 CAS terminal attack controls, and perform autonomous Terminal Guidance Operations (TGO).”



Joint Fires Observer (JFO) Concept



Extends the reach of JTACs.

Focus on Sergeant (E-5 or Above) Fire Support Specialist.

JFO Training at Nellis AFB (AGOS) and Ft Sill.

JTAC-JFO Train and Fight as "One Team."

***Desired End State: 1 JFO per Maneuver Platoon
(Approximately 3,200).***



JFO Training at Fort Sill



- ***Developed JFO Training Capability at Fort Sill (Aug 05).***
- ***JFO Course Training Syllabus jointly approved by USA and USAF.***
- ***Six Courses conducted to date.***
- ***Courses conducted with simulation and live fly.***
- ***Anticipate Class Size of 18-20 students Per Class By Jun 06; 270 trained JFOs projected for FY 06.***
- ***FY 07-08 goal is 400-500 JFOs (20 Classes Per Year).***
- ***USAF has agreed to continue JFO training at Nellis AFB until FY 08.***
- ***Desired End State: 1 JFO per Maneuver Platoon (Approximately 3200).***



JFO Training at Fort Sill



- ***Air Force Detachment re-established. FY 06 End Strength is 8-10 personnel.***
- ***Ft. Sill investments include both systems and instructors.***
- ***JFOs receive training/familiarization on Precision Strike Suite for Special Operations Forces (PSS-SOF).***
- ***Course submitted, approved and included in JFCOM Course Catalog.***
- ***Desired End State: A fully resourced course, manned with adequate instructors and operators, equipped with simulators, with access to ranges for live sorties, producing JFOs to meet Army requirements.***



Joint Targeting

2004 - 2005

Operation Iraqi Freedom
Mensuration Performed
Only at AOC (Theater Level)
with
no "*Eyes On Target*"





Joint Targeting

2006 →...

Operation Iraqi Freedom
Precision Coordinates Performed
by
Ground Based Observers
"Eyes On Target"



***Placing precision strike Capabilities
at the Tip of the Sword***



Return of Air Force Detachment to Fort Sill (Ongoing Since 15 May 05)



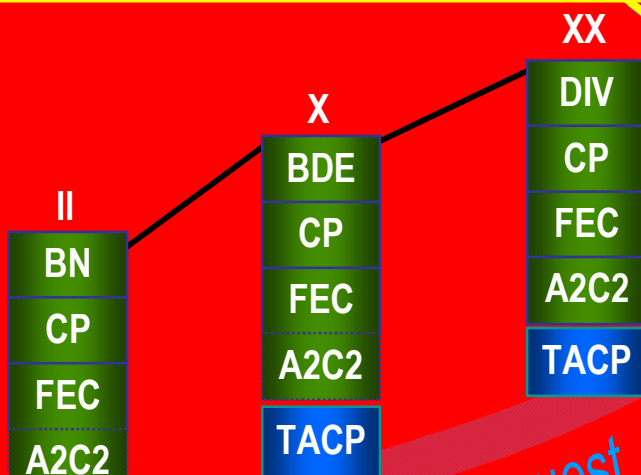
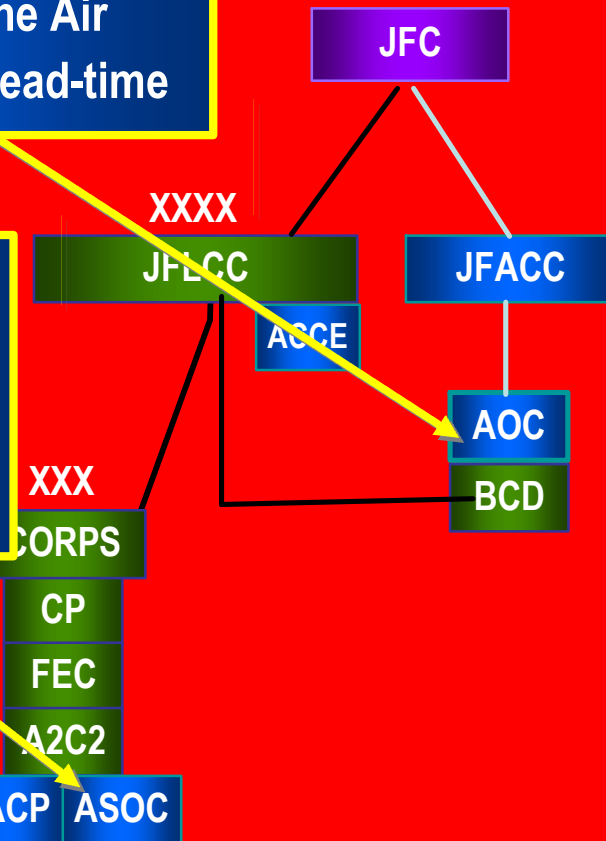
- ***USAF supportive and working issues to provide manning and support.***
- ***Anticipated AF Detachment FY06 End Strength by is 8-10.***
 - ***Currently 6 on station.***
- ***USAF (ACC) pursuing FY 08 POM support for manning.***
- ***OK Air National Guard manning will 'bridge' through FY07.***
- ***FY 08 unit will include both USAF Active Duty and OK Air National Guard personnel.***
- ***Linkage established with USAF units for live fly opportunities for JFO Course and sustainment training.***
 - ***Working with 7 different flying units.***
 - ***Urban CAS Scenarios included with B-52s from Barksdale AFB (Targeting Pods) and B-1s from Dyess AFB.***
- ***Desired End State: Fully integrated Air Force Detachment, enabling better Air-Ground Operations and development of Army/Joint Doctrine.***



Historically, target Mensuration has been Accomplished in the ISRD Division of the Air Operations Center and Requires hours of lead-time

OIF/OEF

The real-time need for JDAM employment in support of Troops-in-Contact Situations has led to a push for A Mensuration capability at the ASOC
Typical Response Time: 15 to 45 minutes



PSS-SOF moves the precision strike capability to the tip-of-the-spear.
Response Time:
Less than five minutes

JFO



Air Force Air Request Net

UNCLASS



Precision Strike Suite for Special Operations Forces (PSS-SOF)



Requirement

- “Digital Divide” still exists for Precision Engagement by Tactical Users
- ✓ Strikes still called over voice nets using “non-integrated” GPS, LRF, map and compass
- ✓ Coordinates lack pedigree for PGMs
- ✓ Different delivery platforms require coordinates in different formats

Background

- National Geospatial Intelligence Agency (NGA) validated capability for PGM targeting and mission planning
- ✓ Hosted on user’s existing systems
- ✓ First deployed to OEF in DEC 2001

Discussion

- Common component in emerging Service Programs of Record
- ✓ SOCOM Special Operations Mission Planning Enhancement
- ✓ USAF TACP-Modernization
- ✓ USMC StrikeLink
- ✓ AFSOC Battlefield Air Operations Kit
- ✓ USA Forward Observer System

Status

- In use by SEALs, Special Forces, USA FECs, USAF Special Tactics, USMC Force RECON and MEU Intel
- Training integrated at JTAC and JFO Schools
- Transitions to USSOCOM in FY07 for sustainment
- Recognized by USCENTCOM for targeting



5



1

2

5



4





Precision Munitions



- ***Guided MLRS, Excalibur***
- ***24/7, All weather***
- ***Minimizes collateral damage***
- ***Supports COIN Ops***
- ***Field Artillery is transforming to a Precision Strike Combat Arm!!!***



GMLRS Unitary

Range to Target – 74 KM





First Validation Shot



- ***4 x 5 Meter Target***
- ***53 Kilometers***
- ***Point Detonation***





First Validation Shot





Second Validation Shot



- ***50 x 200 Foot Target***
- ***65 Kilometers***
- ***Point Detonation and Delay***





Second Validation Shot





GMLRS Unitary

OIF 10 Sep 05





Excalibur

Range to Target – 15 KM





Excalibur

Range to Target – 15 KM





C-RAM



- ***Counter-Rocket Artillery Mortar***
 - ***System of systems to counter the indirect fire threat***
 - ***7 Pillars***
 - ***Shape, Sense, Warn, Protect, Intercept, C2, Respond***
- ***Successful in Theater and at NTC***



C-RAM at NTC

Integrated Base Defense System of Systems (IBDSoS)



RAID Tower



SCAN EAGLE UAV



Acoustic
Warning to
FOB Personnel

FOB
DETROIT

WAVES



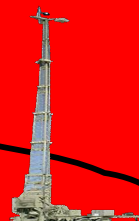
LCMR (C)



IBDSoS



eTASS



RAID



LCMR (C)

Digital
COP



Lethal Indirect
Fires



SCAN EAGLE



POI



FAADC2



AMDWS



AFATDS

3-2

FM/FBC2
Report



OH-58D

Aviation/CAS



Ground QRF



WTSI Camera

LCMR (Constructive)





C-RAM ***155mm Response***





C-RAM

Hellfire Response





Joint Combat Operations

MG David C. Ralston
Chief of US Army Field Artillery

Precision Strike Association



MG Jeff Sorenson

Deputy for Acquisition and Systems Management
Office of the Assistant Secretary of the Army
(Acquisition, Logistics and Technology)
April 19, 2006

Agenda

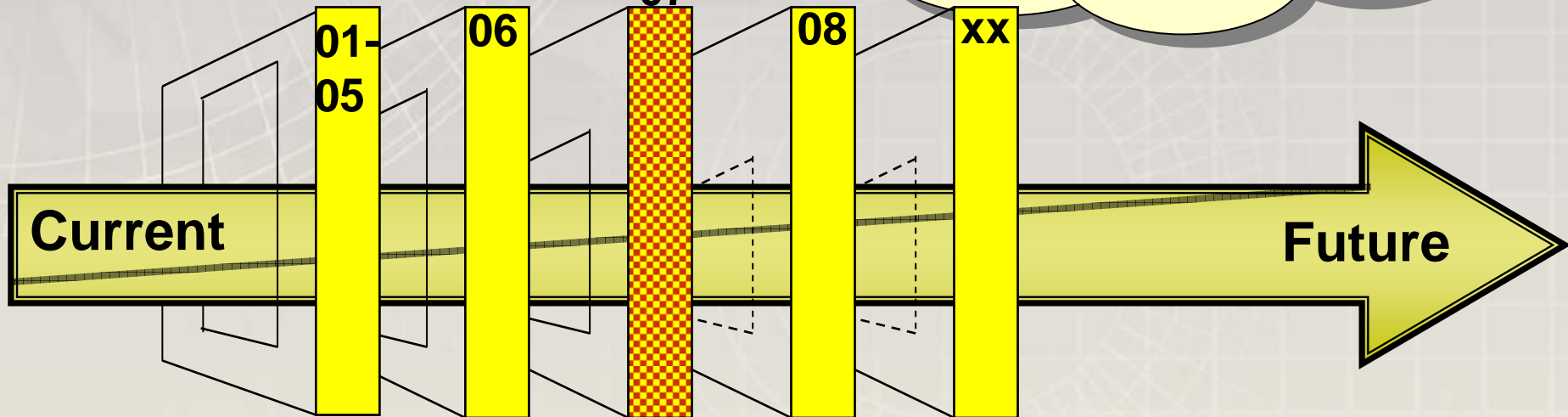
- Current Strategic Environment
- What is Precision?
- Jerry McGuire – “Show Me The Money!”
- Future Investment Strategy
- Industrial Base – Viable or Declining?

A Complex Strategic Environment



Adversity

Threatening Ideologies
Hostile Regimes
Weapons Proliferation
Irregular Warfare



WARTIME FOCUS + WARTIME RESOURCES

= WINDOW OF OPPORTUNITY

Uncertainty

Progress of GWOT
DoD Transformation
Recruiting and Retention
Role of NATO/UN/NGOs

Supplementals
Public Will
Int'l Coalitions



Munitions Terminology

Precision Munitions

Capable of self locating and maneuvering to a specific location with an accuracy sufficient to yield a high probability of destruction within its inherent capabilities.

Smart Munitions

Self-contained capability to search, detect, acquire, and engage individual targets by detecting the general target characteristics in order to provide terminal guidance for the munition or submunitions.

Discriminating Munitions

Self-contained capability to search, detect, acquire, and engage individual targets by distinguishing specific characteristics of the target to selectively identify and engage only the desired target types.

Precision Munitions -- Why?

- All-weather, terrain, and operational environment engagement capability that reduces operational risk by providing immediate responsive fires and scalable effects
- Minimize collateral damage, especially in urban settings; allows for discriminating use of force
- Reduce number of rounds needed to defeat targets at all ranges (same CEP at any range)
- Reduce logistics footprint and force burden
- Essential to fulfill objectives of Transformation and Joint ops
- Compliment -- not replace – unguided or ‘dumb’ munitions

Precision Munitions – Why Not?

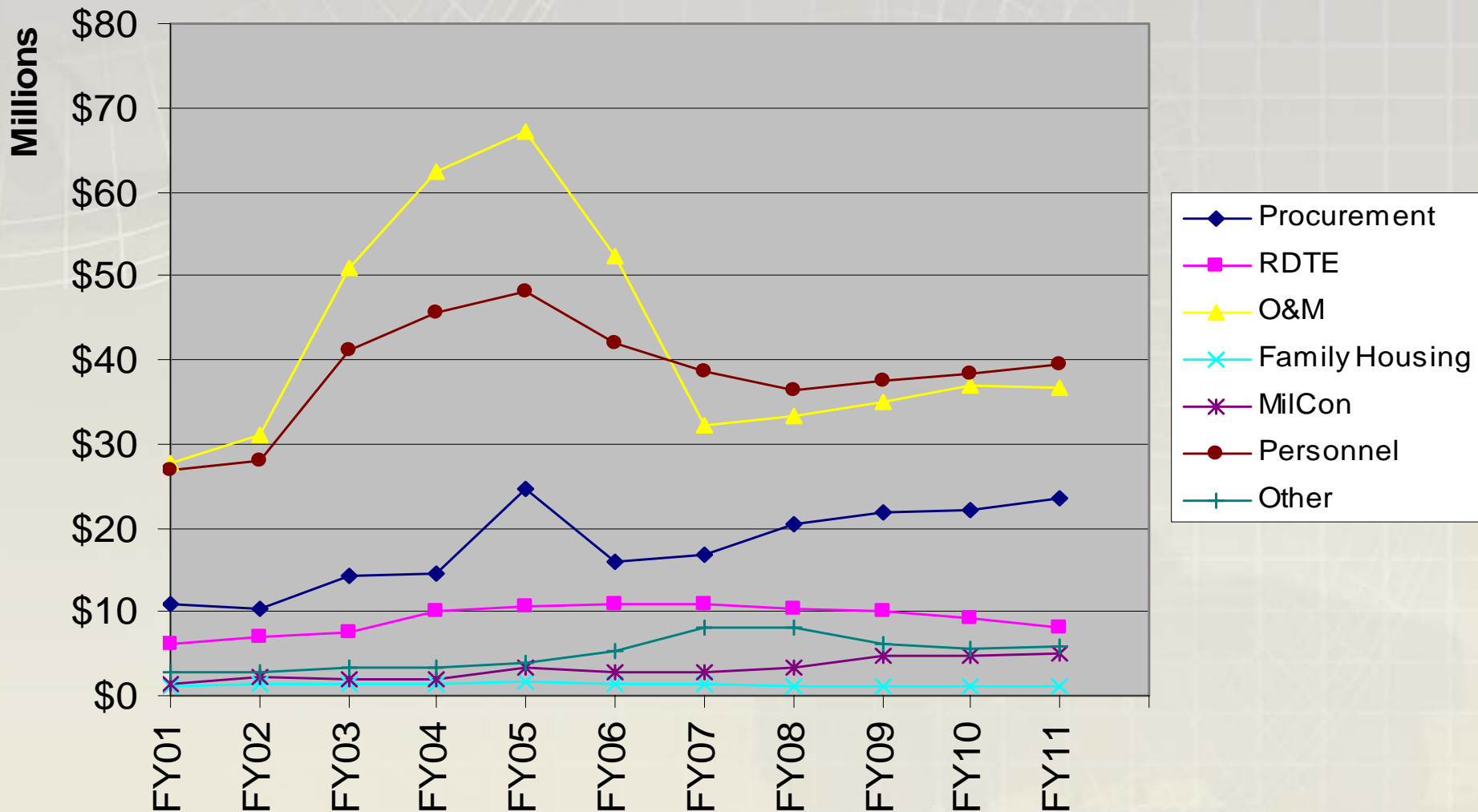
- Not every target needs to be destroyed – suppression, masking, or harassing fire is often needed to shape the battle
- Unaffordable – if chasing too many programs with limited resources
- Insufficient numbers – if they become the weapon of choice
- Dependent on sensor system data, rapidly passed networked information, especially when addressing fleeting targets
- PGM technology is developing ahead of doctrine and infrastructure – modernizing weapons without modernizing doctrine may lead to ineffective use of PGMs

Misconceptions

- **A replacement for unguided munitions – but “dumb” is still good**
- **A leap-ahead advantage – but temporary since eventually precision will proliferate and put our own forces at risk**
- **Leads to quick victory – but the enemy does not always behave the way we think we would**
- **Technology Will Save Us...**
 - **PGMs are not a replacement for sound tactics or strategy (do not confuse the ways and means of war with its end)**
 - **PGMs as the ‘silver bullet’ – but weapons break; human error; enemy countermeasures; not a replacement for doctrine, tactics, or the human element (leadership; will to win; luck)**

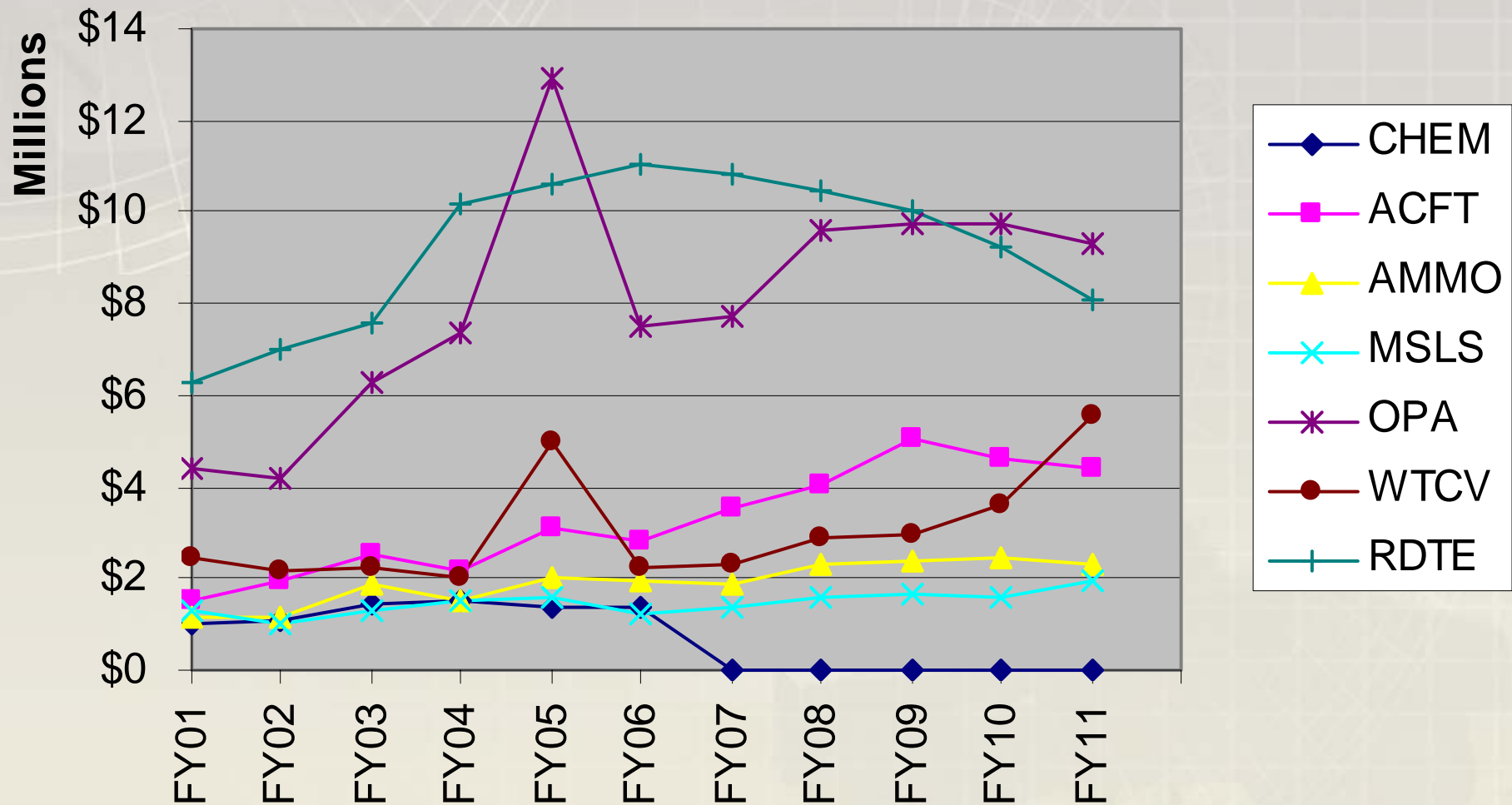
President's Budget (FY01-FY11)

U.S. Army Total (FY01 to FY11) = \$1.3 Trillion



Army Research, Development And Acquisition Summary (FY01-FY11)

RDA Total (FY01 to FY11)= \$304.4 Billion

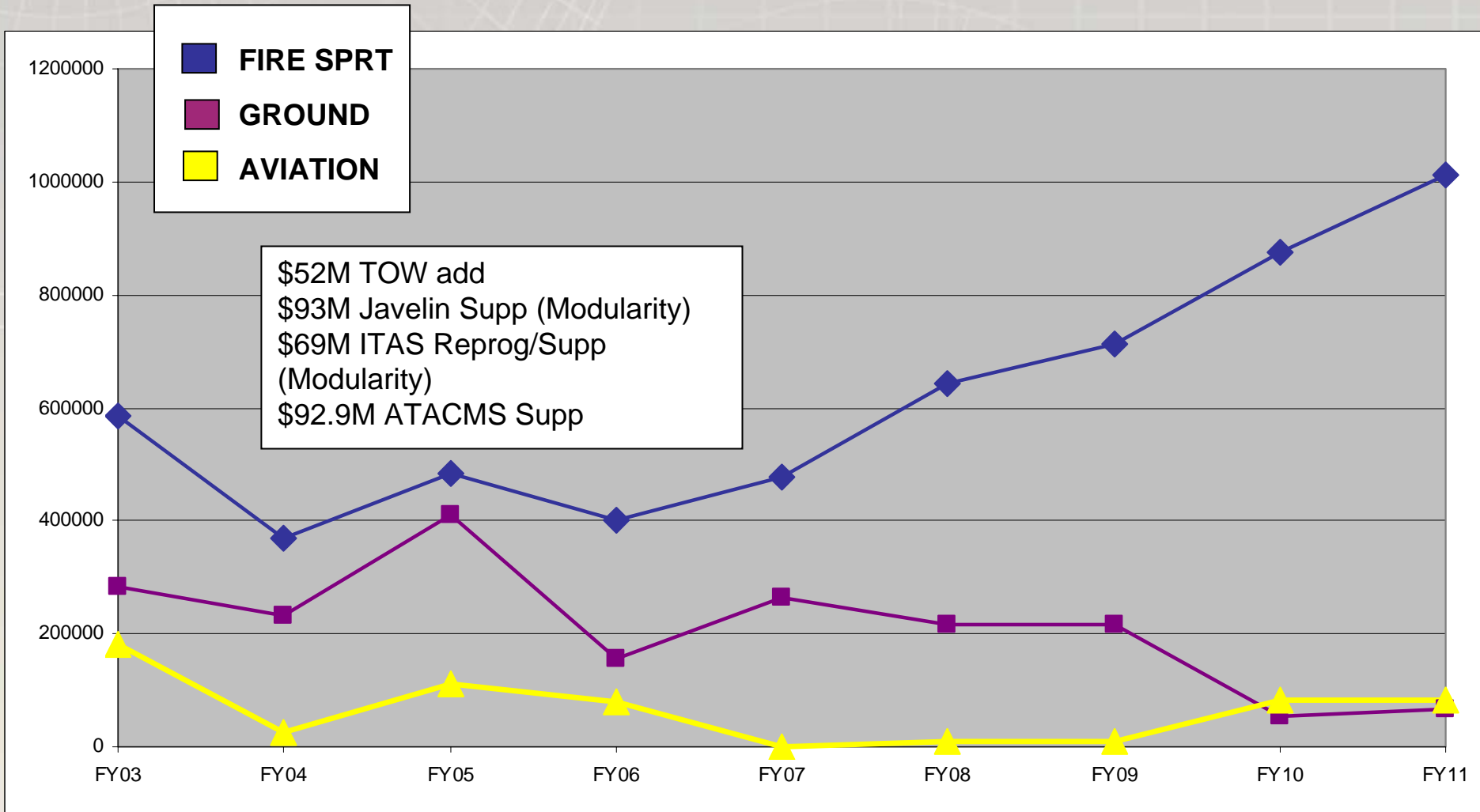


Top Ten Army Programs (2000 vs. 2006)

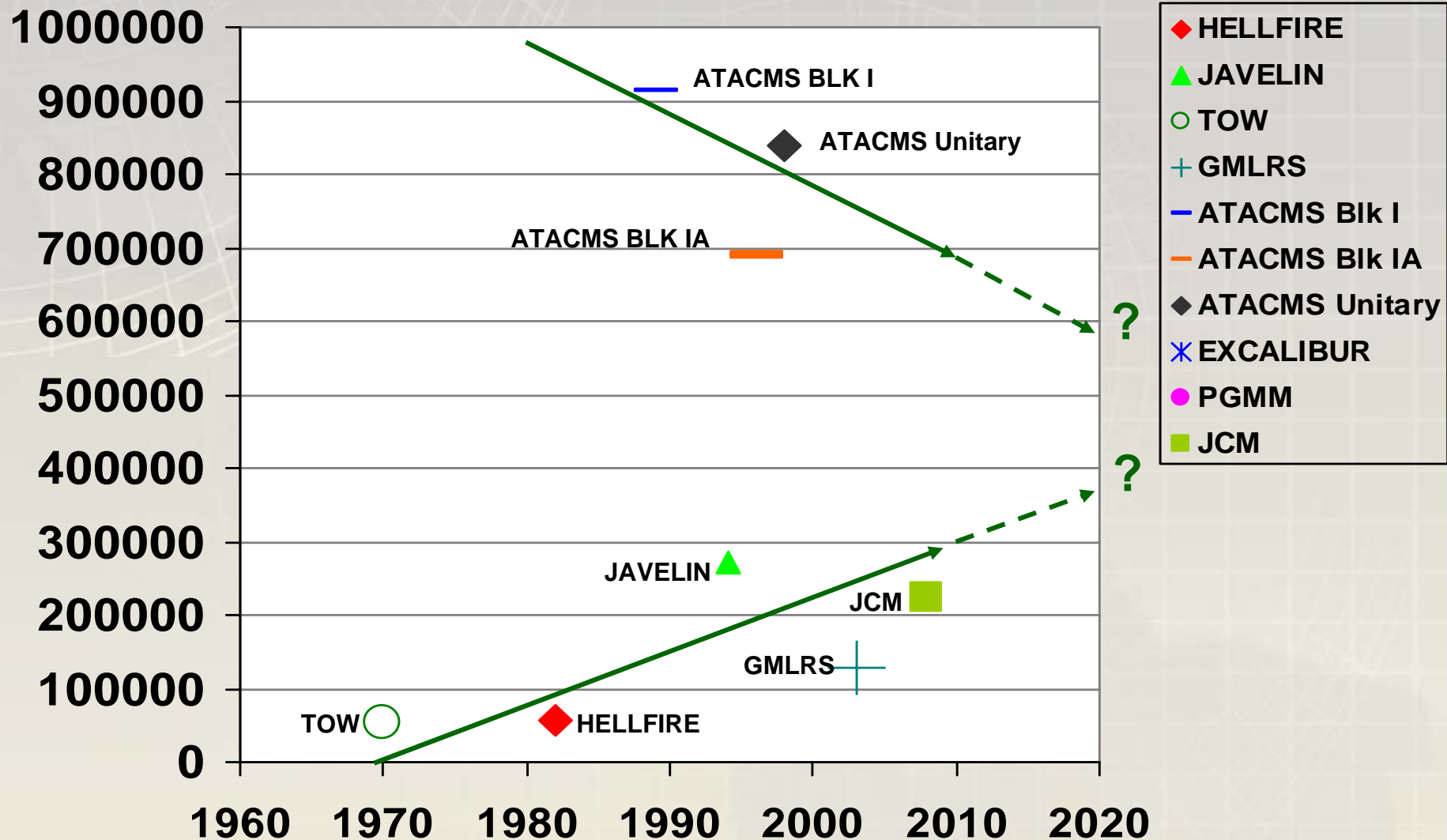
<u>FY 2000 Top MDEPs</u>	<u>FY 2006 Top MDEPs</u>
•TRAINING AMMUNITION	•FUTURE COMBAT SYSTEM (FCS)
•LONGBOW APACHE	•TRAINING AMMUNITION
•TECHNOLOGY BASE	•TECHNOLOGY BASE
•ABRAMS	•STRYKER
•FIRE SUPPORT MISSILES	•Medium Extended Air Defense System (MEADS)
•MEDIUM TACTICAL VEHICLE (MTV) SYSTEMS	•TACTICAL RADIOS
•JAVELIN	•CH-47F Upgrade Recap
•HORIZONTAL BATTLEFIELD DIGITIZATION	•ARMY TEST INFRASTRUCTURE
•COMANCHE	•Apache AH-64D Upgrade Recap
•BRADLEY FIGHTING VEHICLE SYSTEM (BFVS)	•BLACKHAWK

Tactical Missile Procurement

Dollars In Thousands



Missiles/Ammo Initial Unit Cost



Precision Munitions

(Fielded & Developmental)

FIELDIED PRODUCTION SYSTEMS:

TOW 2B

JAVELIN

HELLFIRE variants -- SAL (K, M, or N) and LONGBOW (L)

ATACMS Block IV – Quick Reaction Unitary (QRU)

SYSTEMS IN DEVELOPMENT OR S&T:

PEO AMMO:

Excalibur

PGMM

MRM

PGK

PEO MISSILES and SPACE:

CKEM

APKWS II

JCM – Technical
Maturation

NLOS LS -- PAM

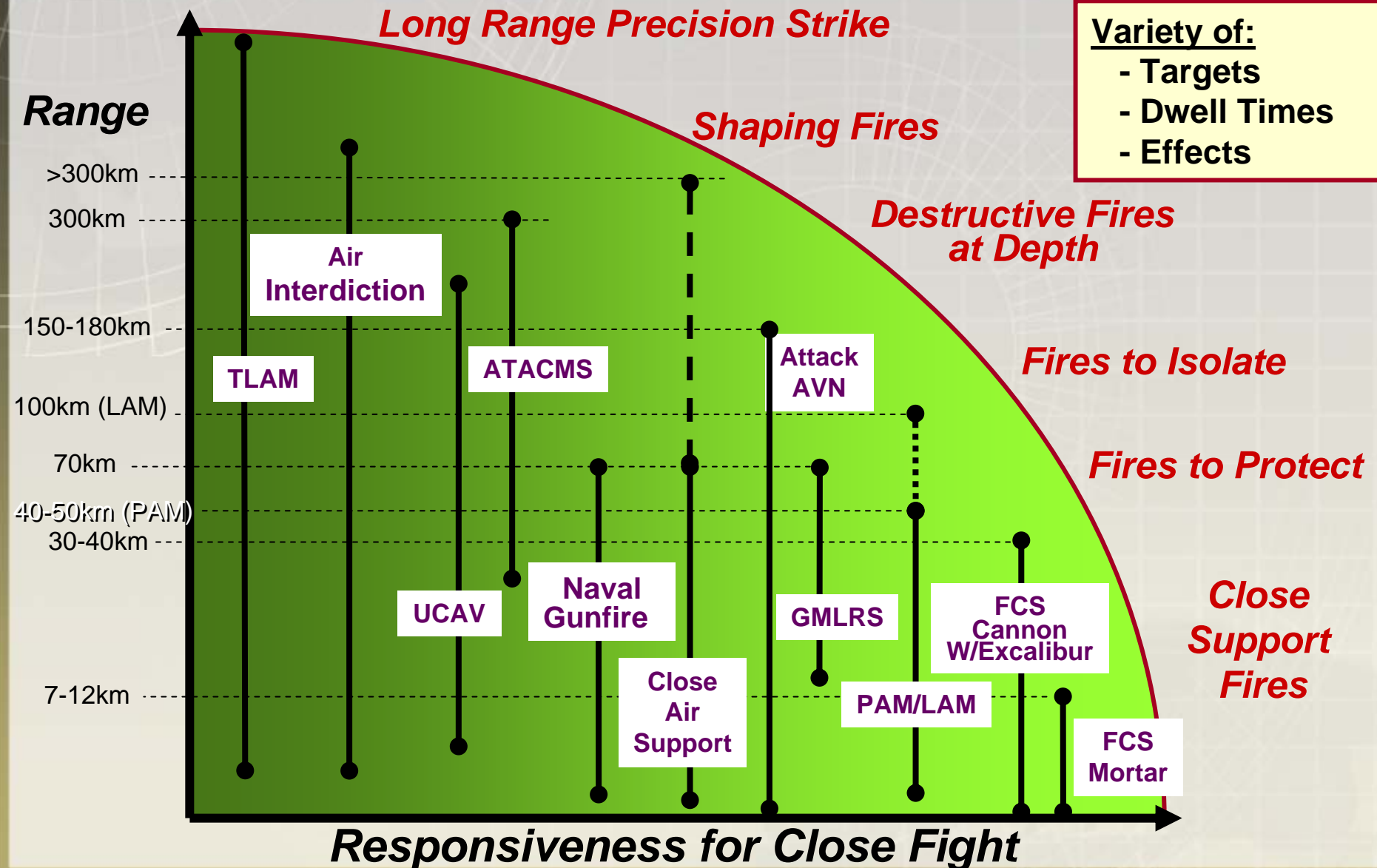
NLOS LS -- LAM

GMLRS

Joint Fires Capabilities

Variety of:

- Targets
- Dwell Times
- Effects



Missiles Expenditures

	GULF WAR 1	GWOT
Air		
Hellfire/Longbow	1770	3441
Anti-Tank Infantry		
Javelin	N/A	682
TOW	2202	5430
Artillery		
MLRS	10,572	840
GMLRS	N/A	54
Unitary	N/A	16
ATACMS (Blk 1)	32	371
ATACMS (Blk 2)	N/A	69

Capabilities for a Joint and Expeditionary Army

Current Force



~100 lb. load



70+ tons



< 10 mph

Enabling the Future Force

Science and Technology—
develop and mature
technology to enable
transformational capabilities
for the Future Modular Force
while seeking opportunities
to accelerate technology
directly into the Current
Modular Force

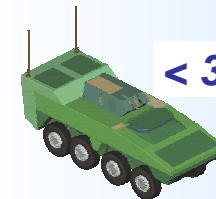
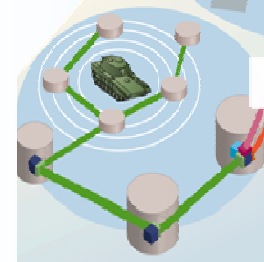
Enhancing the Current Force

Future Force

< 40 lb.
load



Fully networked



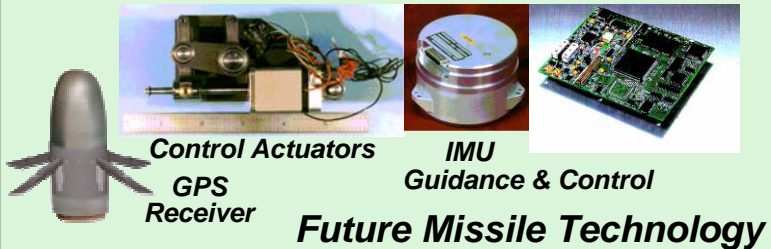
< 30 tons



> 40 mph

Today's Science & Technology Investments for Future Precision Strike Capabilities

Missiles



Smaller, Lighter, Cheaper Munition Components (SLMC)

- Miniaturize electronic assemblies
- Chip-scale packaging
- Advanced sensors and gimbals

Next Gen NLOS-LS

Loitering Attack Missile Increased Loiter time(> 30 min)

Precision Attack Missile Increased Range(>40km)



Lasers

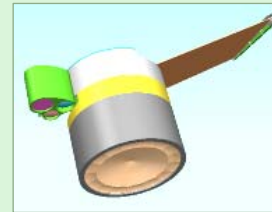
- Counter-rocket, artillery & mortars
- Disrupt/defeat EO/IR sensors
- Scaleable effects



High Energy Solid State Laser

Ultra-short Pulsed Lasers for Laser Guided Energy

Munitions



Common Smart Submunition

- Discriminating I2R & LADAR Sensors
- Long, Aerostable EFP
- 155mm, 105mm, PGMM & GMLRS Applications



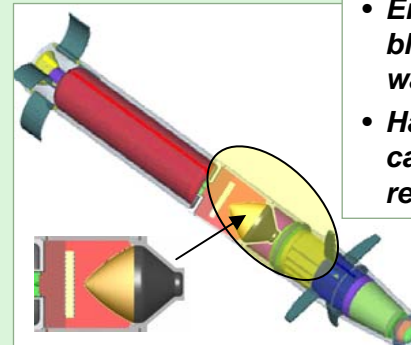
120mm Mid Range Munition

Munition

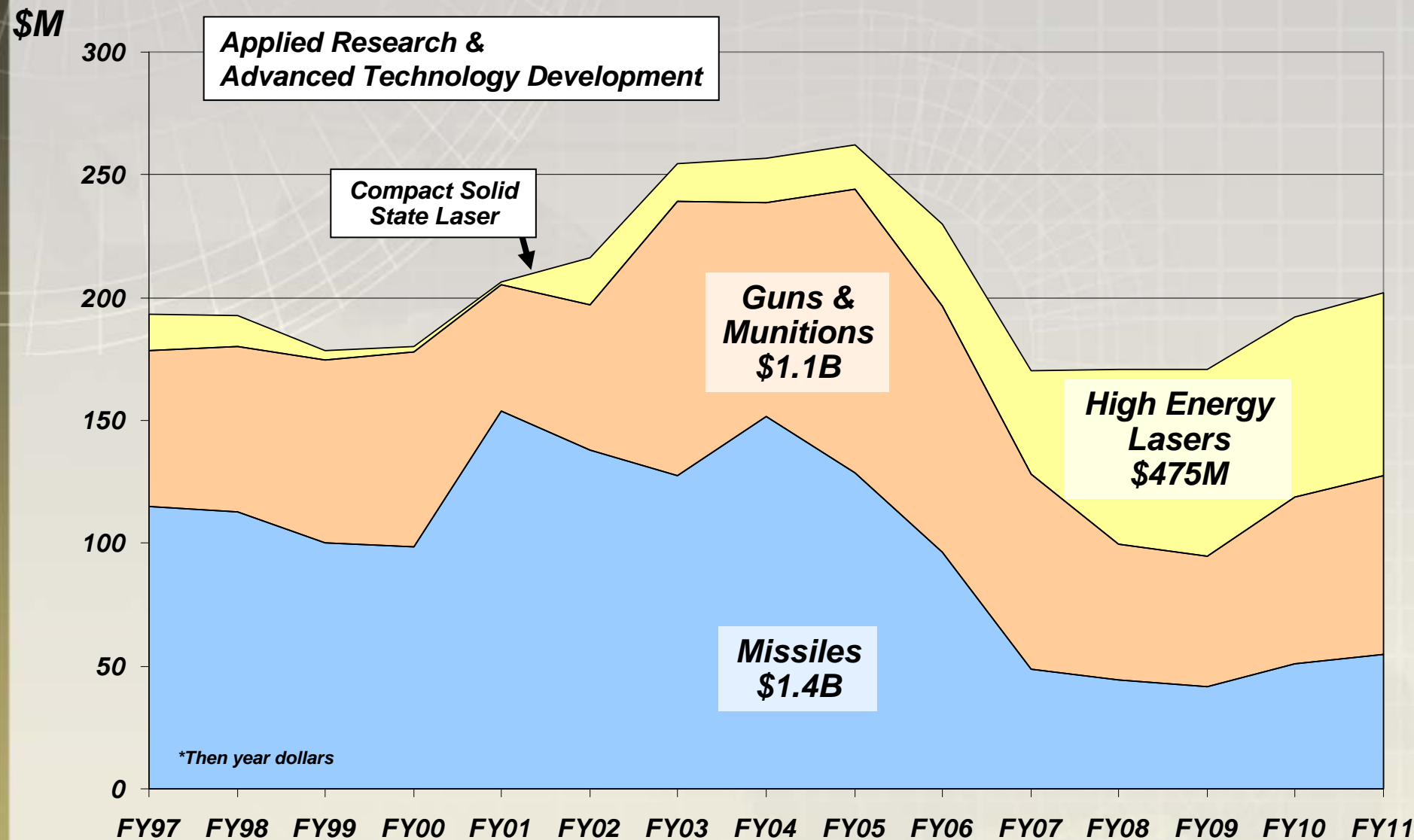
- Range 2-12km (BLOS)
- Autonomous or Laser Designated Seeker Modes
- Hit to Kill

Multi-purpose Warheads

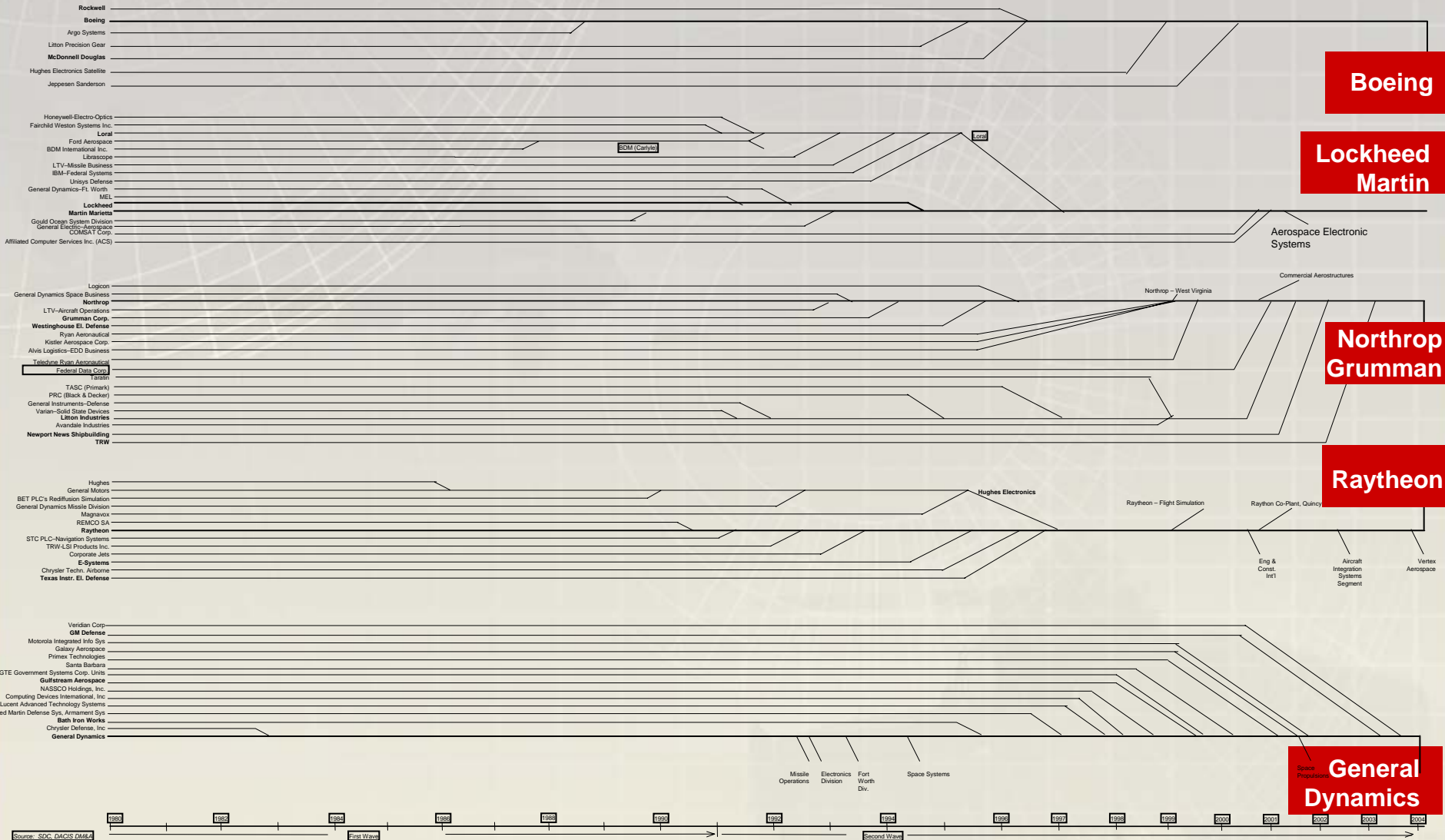
- Single warhead defeats bunkers, heavy/light armor & personnel
- Enhanced Shaped Charge blast/fragmentation warhead
- Hardened for bash-through capability against reinforced structures



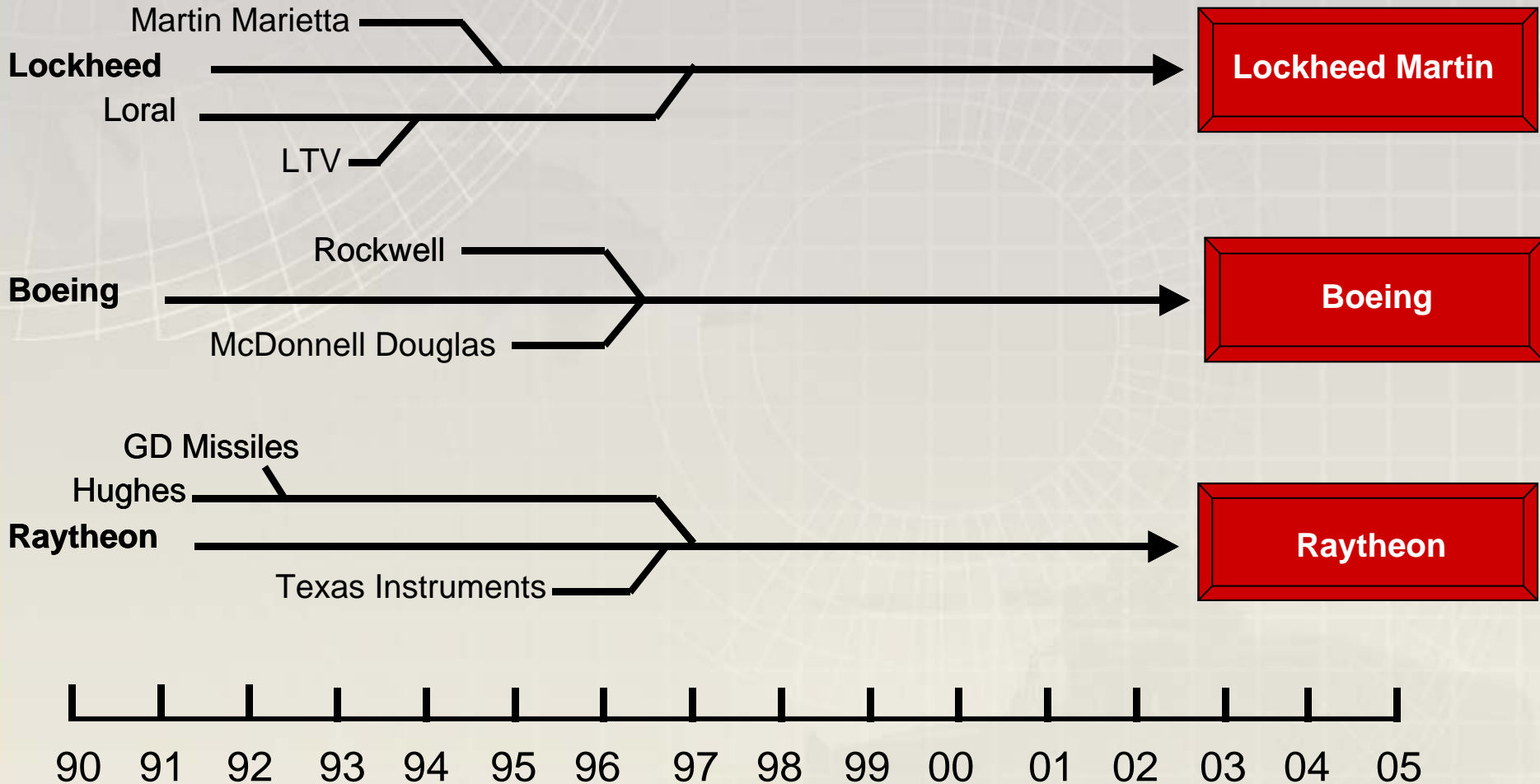
S&T Investments Enabling Precision Strike Capabilities FY97-11, \$3B*



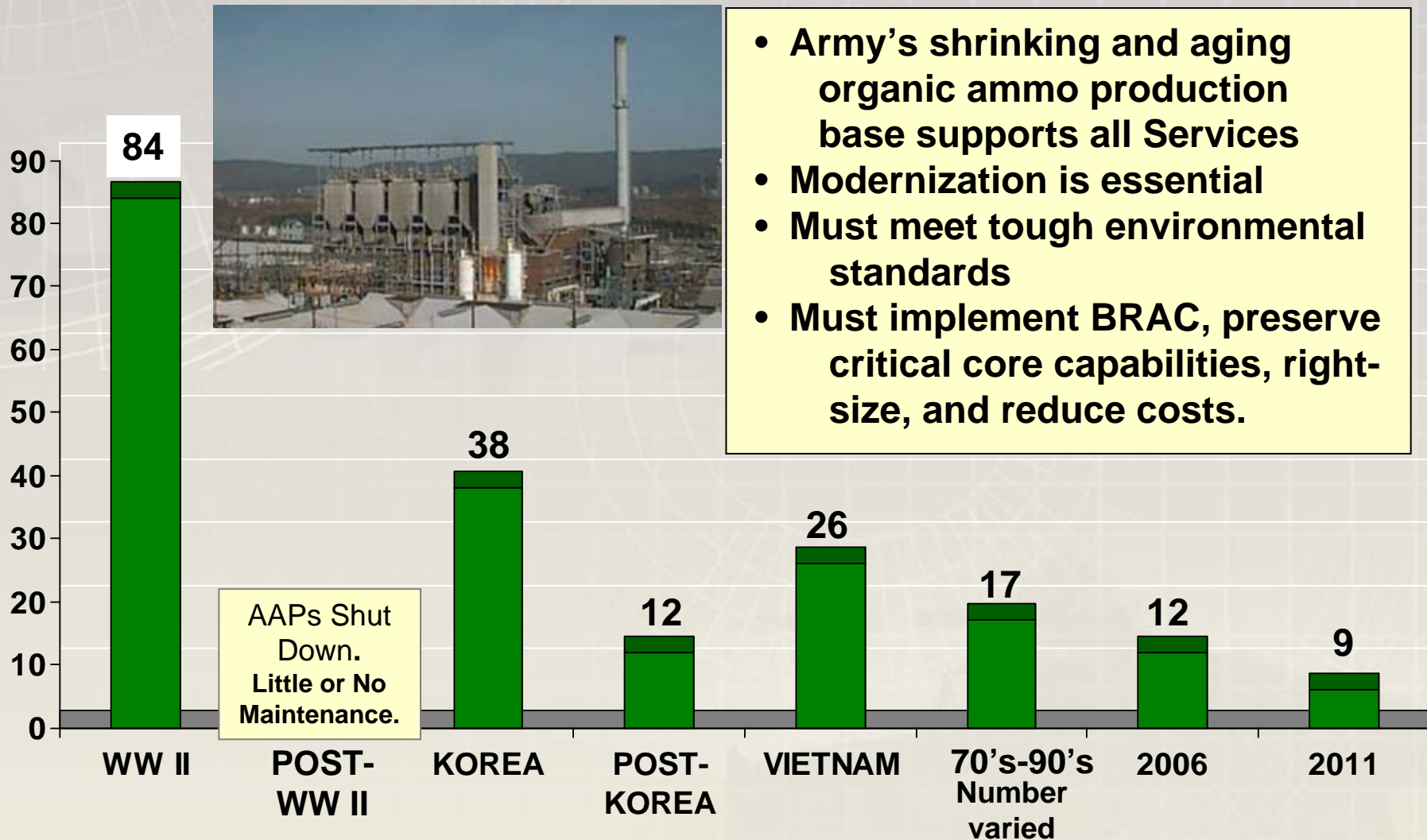
Industrial Base – Family Tree



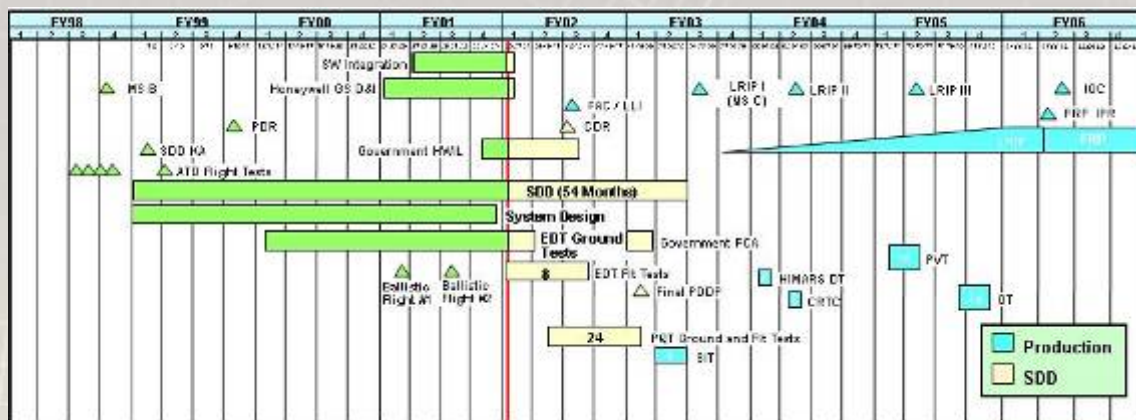
Missile Sector Industrial Base Consolidations



Active Army Ammunition Plants (AAPs) - Government Owned



Success Story



Program of Record (2001)

- ***Did not Include Unitary***
- ***Focused on DPICM “Only” Solution***

**World Events Change
&
New Requirements Evolve**

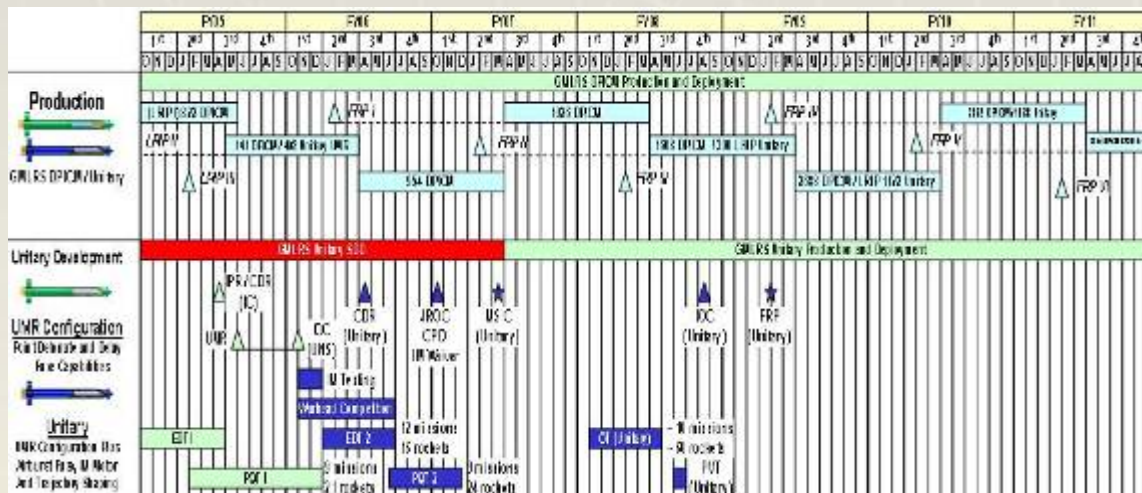
Program of Record (2003)

- ***Included Unitary***
- ***Envisioned Urgent Need Variant***
- ***Considered Warhead Improvements***

Urgent Need Variant

(Dual Mode Fuze & Basic Motor)

**Fielded and 41 Operationally Employed
2005**



Way Ahead

- Investment Strategy for Precision Weapons Portfolio Needs Review
- Precision Lethality – System of Systems Evaluation
- Enormous Stockpile – Demil or Refit?
- S&T Strategy: Sub-Components Improvements or New Technology?
- Industrial Base Declining; Cost of Weapons Increasing



Precision Strike – Industry Perspective

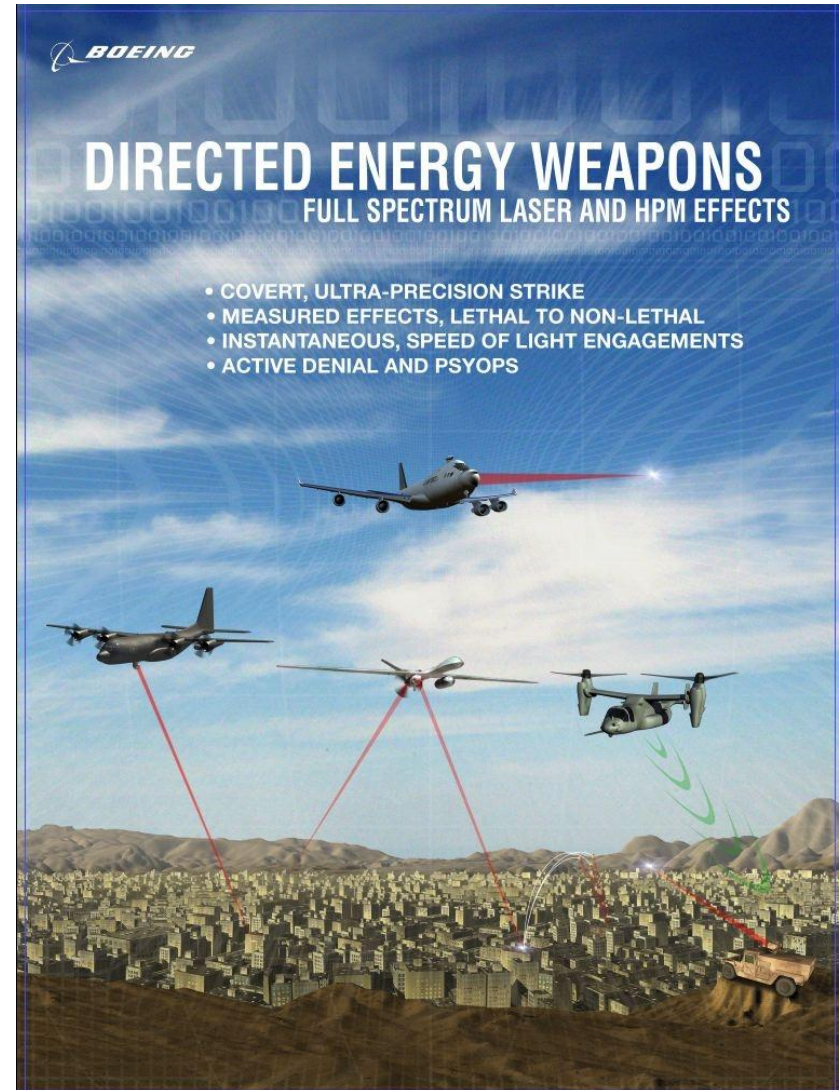
“Closer than you think”

Bob Van Allen
Program Director
HEL and EO Systems

The Promise

Missile Defense Systems |

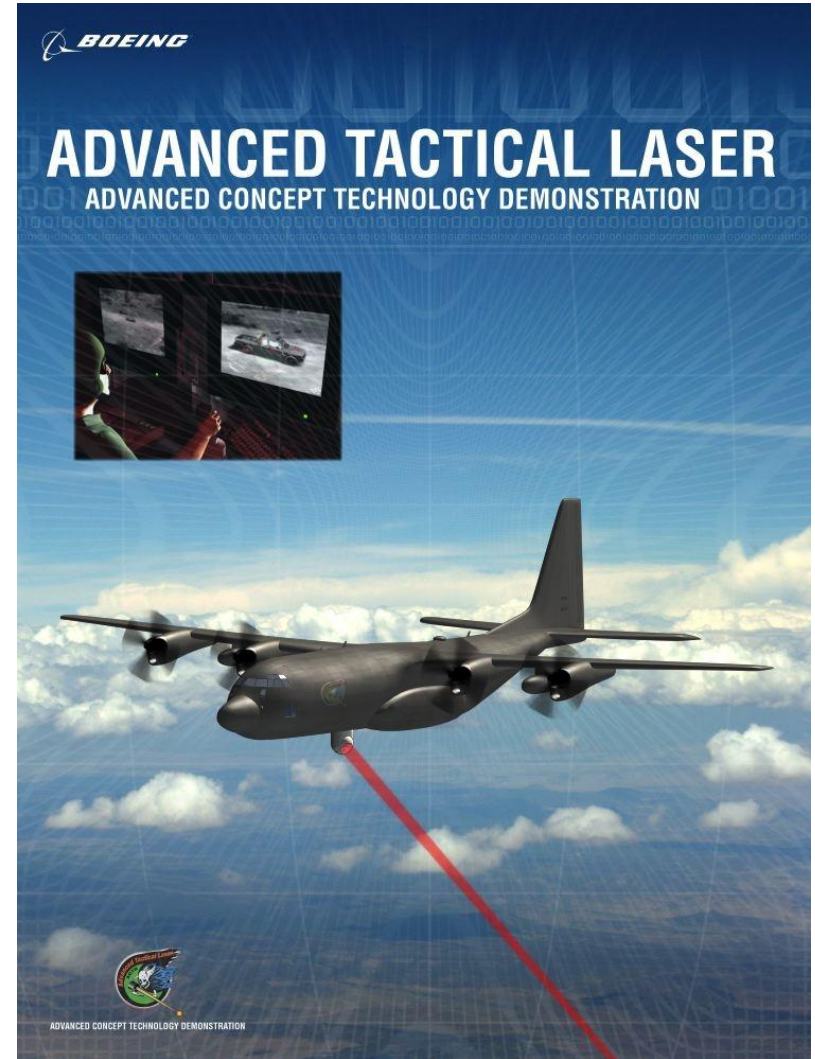
- **HEL Attributes**
 - Speed of light engagement
 - High precision offers low collateral damage
 - Graduated damage effects
 - Concurrent sensing capabilities
 - Deep magazine potential
 - Standoff range
- **Challenges**
 - Field of regard limited to Line of Sight
 - Atmospheric losses over long propagation lengths
 - Availability subject to weather: Clouds and obscurants limit field of engagement



HEL Programs Are In Integration and Field Test

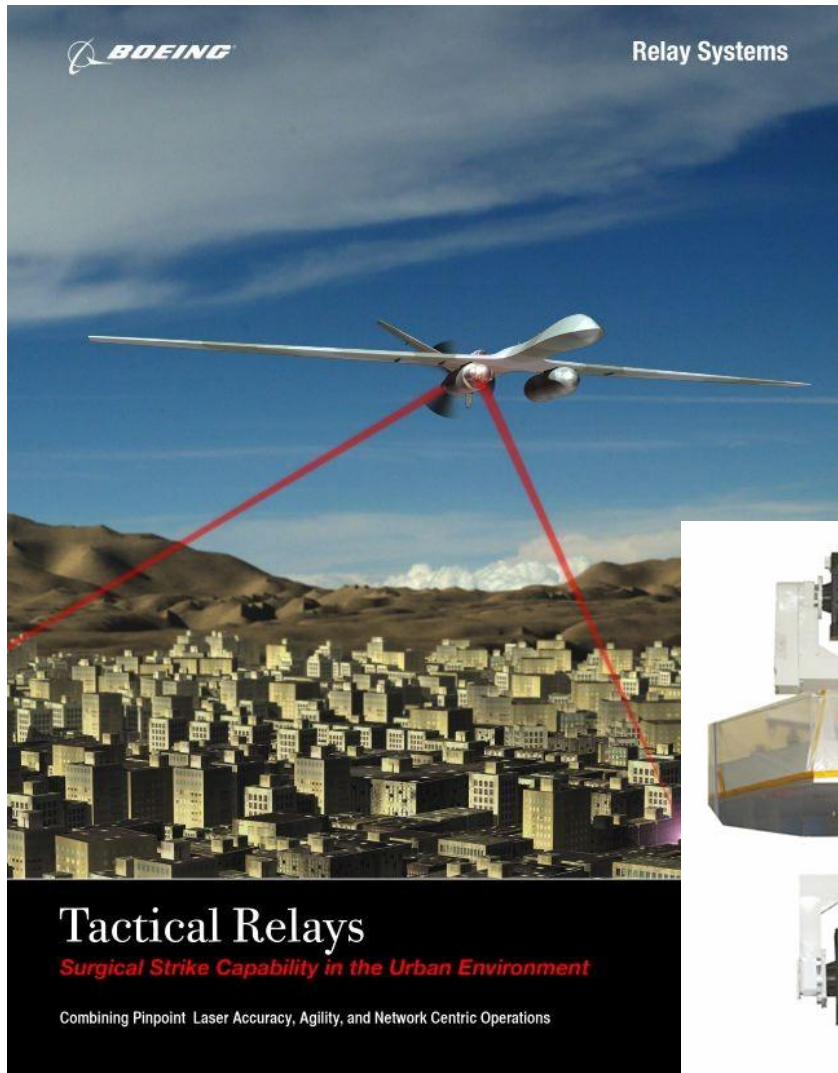
Missile Defense Systems |

- Airborne Laser (ABL)
- Advanced Tactical Laser (ATL)
- HEL Relay Systems (“redirected energy”)



HEL Technology is Maturing

Missile Defense Systems |



Hurdles

Missile Defense Systems

- **System/technology readiness**
- **Military utility and effects**
- **Development/ life cycle cost**
- **Development Funding**
- **Policy**





Status and Operational Implications of Laser Weapons

By

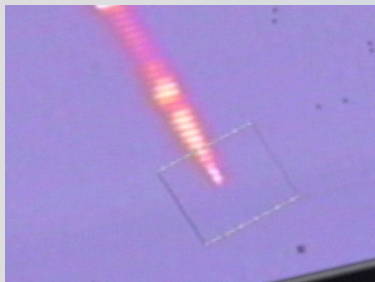
Dan Wildt

Northrop Grumman Space Technology

Growing Laser Weapons Capability



- Tactical High Energy Laser has shot down:
 - Rockets
 - 122mm-Katyusha
 - Short range ballistic missile
 - Artillery
 - Mortars



Airborne Laser (ABL)

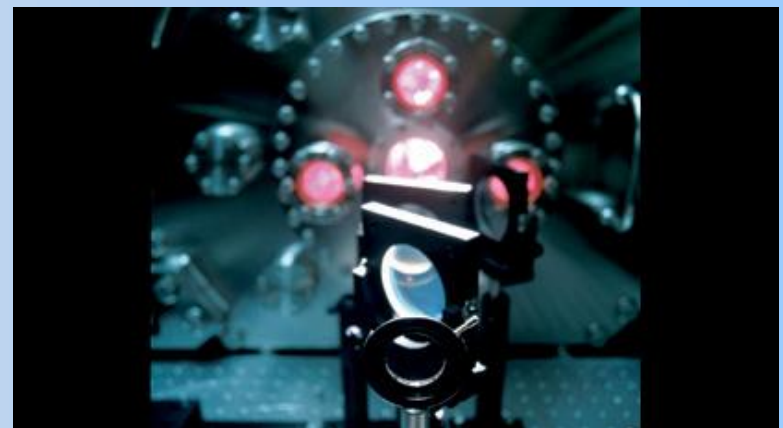
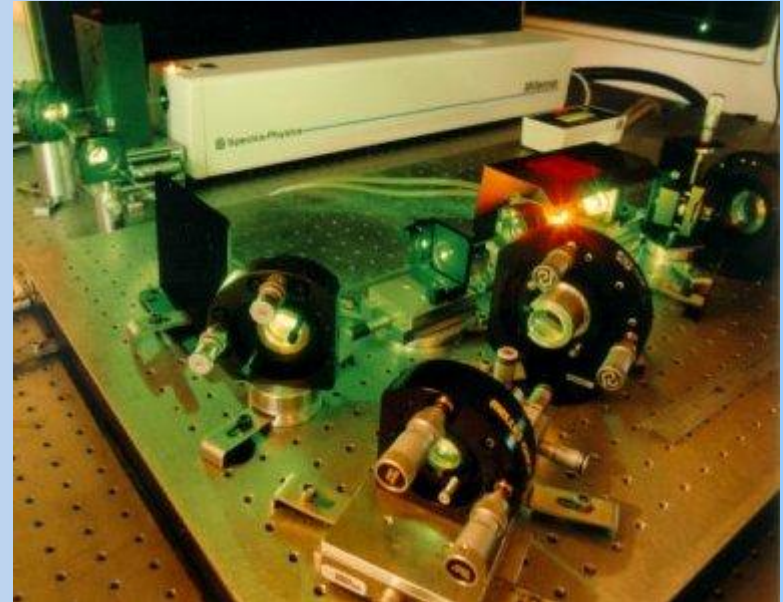
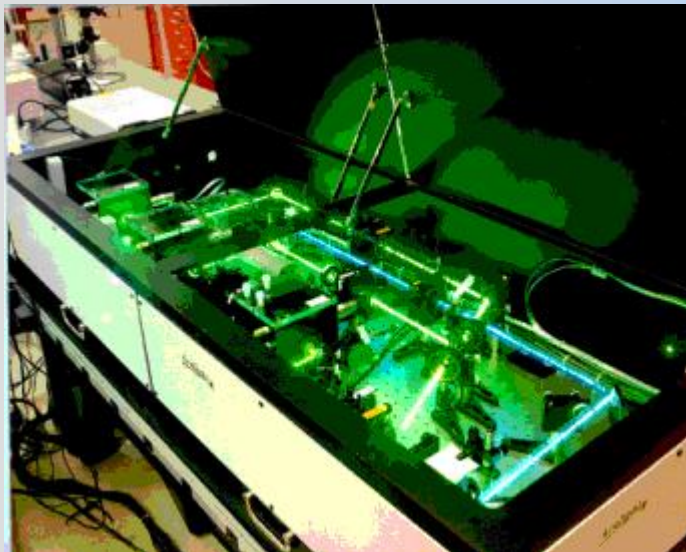


High Power Laser:

- World's First MW-Class COIL Laser
- World's First MW-Class Airborne Laser
- Demonstrated weapons-class power full duration run in 2005

Solid-state Lasers

- Solid-State Laser Programs approaching militarily significant power levels



Operational Implications

- Balancing the strengths of laser weapons against their operational limitations makes them well suited to roles in two key mission areas:
 - Active Defense: providing air, land, sea, and space platforms the ability to defend themselves, other platforms, and large areas against missiles, aircraft, bombs, artillery shells, or rockets.
 - Offensive Strike: providing the capability to achieve lethal or non-lethal effects against a range of suitable targets.

Defensive Operations

- **Air Platform Active Defense**
 - Increases the survivability of aircraft
 - Reduces SEAD requirements



Ground-based Laser Defenses



- Increases ground force survivability
- Enhances freedom of maneuver

Naval Self Defense

- Provide fleet defense against wide spectrum of threats



Defense of Critical Infrastructure

- Protect critical infrastructure against range of threats



Offensive Operations

- Most likely dedicated to missions where precision, speed, numbers of engagements are more important than pure destructive power.



A Wake-up Call for Warfighters

- Accelerating trend toward increased lethality in many dimensions of the battlespace threatens U.S. offensive dominance...

Triple digit
SAMs



BVRAAMS



Supersonic
ASCMs



TBM



Indirect fire
PGMs



Conclusion

- Laser weapons can potentially reverse that trend by increasing the ability of U.S. forces to defend against threats that are otherwise difficult or almost impossible to defeat

